Erie Non-Potable Water Master Plan update

TOWN OF ERIE
1874

Prepared by

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ES.1 Introduction

The Town of Erie is located north of Denver in Weld and Boulder counties in Colorado. Erie was incorporated in 1874 and existed as a small coal mining town. In the late 20th century, Erie began to grow into a bedroom community for larger cities in the region. Beginning in the 2000's, Erie's population grew at a tremendous rate, increasing from a population of 1,258 to 18,135 from 1990 to 2010 (US Census Data).

This Plan updates a previous non-potable water master plan completed in 2007. The Plan identifies potential areas that can be reasonably be served by non-potable water in the short term to mid-term planning horizons. The Plan also identifies infrastructure to deliver non-potable water to these areas. This Plan does not constitute specific Town policy regarding non-potable use requirements for future developments and does not consider all possible future growth in Erie.

The Plan and Executive Summary are organized as follows:

- Description non-potable water supply and infrastructure (Section 2 and ES-2)
- Quantification of non-potable demand (Section 3 and ES-3)
- Existing and Proposed non-potable infrastructure (Section 4 and ES-4)
- Non-Potable System Operation (Section 5 and ES-5)
- Opinion of Probable Costs (Section 6 and ES-6)
- Resources for Landscaping with Non-Potable Water (Section 7 and ES-7)

ES.2 Water Supply and Infrastructure

Non-potable water is a term used in this Plan to describe water that is not treated to drinking water standards, but is acceptable for use for landscape irrigation. Water supplies such as Colorado-Big Thompson Project (C-BT) deliveries and irrigation ditch company shares that are not treated for potable purposes, but delivered directly for irrigation use are termed in this report as "raw water." Effluent from the Town's NWRF that is treated to meet Colorado Department of Public Health and Environment reuse standards as defined in Regulation 84 is termed "reclaimed water" in this Master Plan. Both raw water and reclaimed water are non-potable supply sources that can be used to meet non-potable water demands.

Erie currently has or is in the process of obtaining multiple water sources that can be used to meet non-potable demands:

- Colorado-Big Thompson Project (C-BT)
- Used primarily for potable water
- Cannot be reused, but can be used for non-potable use
- Ditch shares
- Can be used on historically irrigated lands
- Some shares of Leyner Cottonwood changed to municipal use that can be reused
- Windy Gap Project
- Reusable supply
- Erie is a participant in the Windy Gap Firming Project to increase this sources dry-year reliability
- Northern Integrated Supply Project (NISP)
- A portion of this water is reusable
- Erie is a participant in the permitting process for this source

Erie can use its reusable Windy Gap and NISP and changed ditch shares first through the potable system and capture the reusable wastewater effluent for reuse as reclaimed water. By using this water in the winter months, the amount of water consumed through the first use is small compared to using this water in summer months, and nearly 95 percent of the first use water returns to the wastewater treatment plant where it can be treated and stored for subsequent reuse. Windy Gap and NISP water can also be used in the summer, but much more of the water is consumed through outdoor watering. Because Windy Gap and NISP are reusable supplies, Erie increases its reusable water supply by using Windy Gap and NISP in the winter.

Use of reclaimed water falls under Colorado Department of Public Health and Environment Regulation No. 84. Regulation 84 requires certain levels of water quality requirements, water quality monitoring, staff training and provides a listing of approved uses, including landscape irrigation. Use of reclaimed water for irrigation uses is often restricted to nighttime hours to minimize potential human contact with the reclaimed water.

ES.3 Non-Potable Water Demand

Non-potable demands associated with landscape irrigation of residential areas, medians, parks, and commercial, and industrial areas are expected to comprise a significant portion of Erie's overall water demands. The Plan focuses on cost-effective opportunities to supply these demands with non-potable supplies. Irrigation of single family residential lots is recommended to continue to be supplied with potable water.

Erie currently delivers untreated raw water (non-potable water) directly to Lehigh Park in Erie Commons, adjacent rights of way within Erie Commons, and the Erie Community park and recreation center turf area. It also supplies non-potable water via exchange from Coal Creek to serve the Colorado National Golf Course and Columbine Mine Park in the Vista Ridge subdivision. Erie constructed a 1,000 AF reclaimed reservoir at the NWRF (NWRF Reservoir), pump station and reclaimed line from the NWRF to the SWRF. The NWRF reservoir can store reclaimed water treated in the winter for delivery the following irrigation season and can provide regulatory storage throughout the year. The reclaimed line has not yet been used to deliver reclaimed water, but design is underway to extend this line to the new Bridgewater development, just east of Historic Erie.

Potential future demands for non-potable water were quantified from potentially converting existing parks from potable supply to non-potable supply, and by estimating demands at future developments within Erie. Conversion of existing parks would add approximately 78 AF of non-potable demand to the system. Other potential customers such as Homeowner Associations (HOAs) with large common areas or other smaller greenbelts and parks and rights-of-way could add more than 400 AF of non-potable demand to the system, but may not be practical from a cost perspective to serve with non-potable water.

Demands at future residential developments within Erie were estimated from the Unified Development Code (UDC) requirements for parks, rights-of-way and other common areas. It was estimated that 12 percent of the raw developable land could be irrigated with non-potable water, of which approximately 70 percent would be turf or bluegrass. A target irrigation application of 30 inches on turf areas and 12 inches on other areas such as shrubs, trees and flower beds was used to estimate non-potable demands. This results in a potential non-potable demand of 0.23 AFY per acre of raw developable residential land. The demand for commercial areas was assumed at half the residential demand based on visual inspection of existing commercial properties along the I-25 corridor.

Future demands were estimated based on the size of parcels identified by Town staff for development within short-term to mid-term planning horizons. A 25 percent increase in demands was added to account for potential new customers that may wish to utilize non-potable water that are not included in the demand estimate, such as schools, HOAs and small commercial developments. Using this approach, the future demand was

estimated at 2,047 AFY. Annual demand was disaggregated to monthly demands using methods utilized by Northern Water, with the maximum demand of approximately 400 AF in June and July.

This demand estimate accounts for areas identified by Town staff that are likely develop in the near term. The demand estimates do not account for the full buildout potential in the Erie planning area, and may increase with growth beyond the areas analyzed.

ES.4 Non-Potable Water Distribution Infrastructure

Design and construction of the system is separated into 5 phases that can be built as development occurs. Erie has the ability to use both reclaimed water and raw water supply to meet non-potable demands, and in some areas this Plan proposes to use the same infrastructure for both reclaimed and raw water supply. The current system uses raw water directly and reusable effluent by exchange. As noted, the NWRF reclaimed water reservoir and the first segment of the reclaimed pipeline from the reservoir to the SWRF have been constructed. The proposed system through Phase 5 of the non-potable system integrates the raw water and reclaimed water distribution systems to provide for system redundancy when raw water supply is low, minimizes operational costs and maximizes operational flexibility.

The ability to convey raw water to customers who normally receive reclaimed water allows for periodic flushing of salts that accumulate in soils from application of reclaimed water using the raw water that has a lower concentration of total dissolved solids (TDS).

Infrastructure was sized based on a peak-week application of 3 inches, representing 10 percent of the annual demand. It is generally desirable to irrigate with non-potable water during nighttime hours when parks and playing fields are not in use. In addition, use of reclaimed water may be limited to nighttime hours by the Regulation 84 permit requirements. In order to maximize the non-potable system infrastructure, the non-potable delivery system can be utilized during daytime hours to deliver water to users in the system that have storage ponds. With the addition of water storage facilities, water can be staged in various points in the system to deliver water for irrigation during the night when E-T and risk of human exposure is lowest. Use of storage ponds near demand areas increases the amount of demand that the system can meet in comparison to customers connected directly to the system and only able to use the water during the night.

Local storage ponds can be constructed and used as reservoirs for non-potable water while potentially providing aesthetic qualities to the area

if well designed and integrated into the development. Storage ponds will fluctuate daily during the irrigation season, filling through the day and releasing to irrigation demands at night. This fluctuation can create an undesirable 'bath tub ring' effect or expose mud flats of the reservoir bottom or edges. To reduce these negative aesthetics, several features can be incorporated into the design of the ponds, such as steeper side slopes lined with attractive slide slope retaining materials to reduce the change in surface area through the fluctuations, and addition of a permanent pool in the pond that reduces the appearance of the daily fluctuations.

In order to manage and optimize the capacity of the non-potable supply and infrastructure system, Erie should establish a SCADA system that allows operators at the NWRF to monitor and/or control valves, pumps and irrigation schedules of major customers connected to the non-potable system. SCADA monitoring and/or control of the major non-potable system users allows the Town to optimize deliveries within the pump stations and pipeline capacities and manage energy costs by managing flows rates. Central control of the system also allows for the option to not maintain pressure in the lines at all times, and only pressurize when delivering water.

Figure ES-1 (see also Figure 4-8 and full-size map included with the main report) shows a map of the approximate locations and sizing of infrastructure through Phase 5. More detailed descriptions of each of the phases and specifics of serving each subdivision are presented in sections 4.2 and 4.3 of the main report.

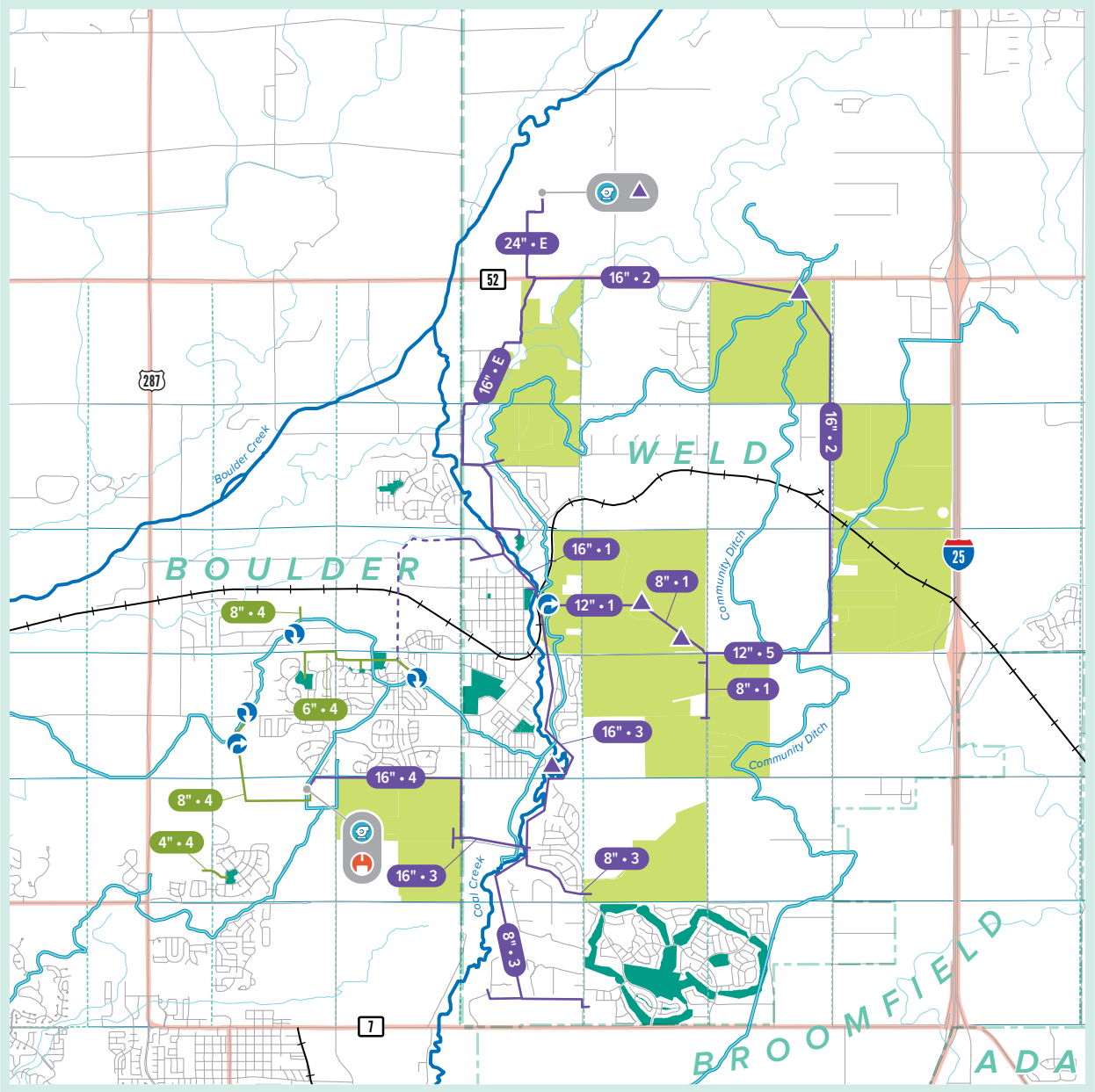
ES.5 Non-Potable System Operation

The non-potable demand that can be met through the phased Plan is approximately 1,700 AF to 2,100 AF. This demand can be met from storage of 1,000 AF of consumable effluent at the NWRF reservoir, ditch shares, direct use of consumable effluent that does not need to be stored in the NWRF reservoir, and from other surplus raw water supply such as C-BT, Windy Gap or future acquisitions of other water rights. Currently, Erie's water supply portfolio can generate at least 1,000 AF of consumable effluent to fill the NWRF reservoir by treating its Windy Gap water in the winter months. In the future, Windy Gap Firming and NISP will yield approximately 7,700 AFY of first-use supply that will generate consumable effluent up to approximately 2,900 AFY.

Most of Erie's ditch water rights have not been transferred to municipal use. Generally, these rights can be used unchanged for irrigation of parks and rights-of-way on lands that have been historically irrigated under the ditch or were part of the originally decreed service area for the ditch. This limits the use of some of Erie's unchanged ditch shares to specific regions and

figure **ES-1.** Map of Non-Potable System Through Phase 5

Oversized version of this figure is available in pocket folder.



LEGEND

- Pump Station
- Air Gap or Backflow Prevention
- Diversion from Ditch
- Discharge to Ditch
- Reclaimed Pond / Reservoir
- Coal and Boulder Creeks
- Canals with Erie Shares
- Proposed Reclaimed or Raw Line
- Optional Line
- Raw Line
- 8" • 4 — Pipe Size • Phase (E = Existing)
- Highways
- Roads
- Railroad
- County Lines
- Section Lines
- Future Growth Parcels
- Irrigated Parks and Golf Course

N

Miles: 0 1 2 5

requires detailed water accounting if these shares were to be diverted into the non-potable distribution water system to show that these shares are used on the lands under the ditch system.

A spreadsheet model was developed to simulate the availability and location of non-potable supplies and the ability to meet projected demands from these sources. Demands were categorized as raw water only, reclaimed water only or either raw water or reclaimed water. Four scenarios were modeled to simulate the current system, the future system under average and wet year conditions, and the future system under an extended drought condition. The model shows that Erie will be able to utilize its reusable water sources and meet a large portion of its non-potable demand through the use of reclaimed water even through an extended drought. During times of surplus raw water (such as high C-BT quota years), Erie will have the ability to meet much of the non-potable demand using raw water, and thereby flushing salts from lands normally irrigated with reclaimed water.

Model results show that the majority of Erie's non-potable demand can be met by a combination of ditch yields, direct use of reusable effluent, and use of reusable effluent stored in the NWRF Reservoir. Surplus raw water supplies are needed in October for areas that are not served by the proposed reclaimed water system (western subdivision and parks), and in dry years when the ditch yields are very low. More information on the model and the results is available in Section 5 of the main report.

Model results also indicate that Erie has the ability to generate more reusable effluent than can be stored in the NWRF. Options for use of Erie's surplus reusable effluent include leasing to other entities or other water exchanges or trades to obtain additional raw water supplies.

ES.6 Opinion of Probable Costs

The capital costs for the proposed non-potable system are shown by phases in the following table:

Table **ES-1.** Capital Cost Estimates by Phase

Phase	Description		Capital Cost
Phase 1	Extension of existing line to Bridgewater, Bridgewater Pond No. 2 and connection to parks and developments near existing line	$	2,251,500
Phase 2	North Line to service north area and I-25 corridor	$	4,106,000
Phase 3	South extension to Vista Ridge area	$	3,468,500
Phase 4	Interconnect with raw water system	$	3,309,000
Phase 5	Loop North Line to Bridgewater extension	$	792,000
Total		**$**	**13,927,000**

The total non-potable demand is estimated between 1,700 AF and 2,100 AF, which corresponds to a cost of approximately $8,200 to $6,700 per AF.

ES.7 Non-potable Irrigation Landscaping resources

There are multiple resources available to assist in landscape design and management using reclaimed water. The following is brief description of two reports compiled for Colorado and Denver, along with references to more general information.

Rocky Mountain Section of the American Water Works Association (RMSAWWA) and the Rocky Mountain Water Environment Association (RMWEA) joint study "Managing Reuse Salinity for Healthy Landscapes" provides a discussion on drainage, advantages of flushing the soils (such as with surplus raw water as recommended in this Plan), and provides guidelines for baseline salinity testing of the irrigation supply and the soil. The report also provides a listing of salt-resistant plants for different levels of salt tolerance.

http://www.rmwea.org/reuse/docs/Managing%20Salinity%20in%20Landscape%20Irrigation%20final%20doc.pdf

Denver Water report on reclaimed water quality, effect on soils, and effect on trees. The report concludes that sodium buildup in soils and plant tissue was of concern, and one possible solution included flushing of salts with potable water, similar to what is recommended in this Plan during years of excess water supply.

http://www.denverwater.org/docs/assets/3F474251-95AA-CE4F-1BD9CD77E18DC541/SoilTreeReport.pdf

Other resources cited by research articles on use of reclaimed water:

Hayes, A., C. Mancino, and I. Pepper. 1990. Irrigation of turfgrass with secondary sewage effluent: I. Soil and leachate water quality. Agron. J. 82:939-943.

Matheny, N., and J.R. Clark. 1998. Managing landscapes using recycled water. In The Landscape Below Ground II. Neely, D., and G. Watson, eds. International Society of Arboriculture, Champaign, IL. 265pp.

Parnell, J. 1988. Irrigation of landscape ornamentals using reclaimed water. Proc. Fla. State Hort. Soc. 101: 07-110.

Pettygrove, G., and T. Asano. 1985. Irrigation with Reclaimed Municipal Wastewater – A Guidance Manual. Lewis Publishers, Chelsea, MI.

Section 1:
Objectives and Background

The Town of Erie is located north of Denver in Weld and Boulder counties in Colorado. Erie was incorporated in 1874 and existed as a small coal mining town. In the late 20th century, Erie began to grow into a bedroom community for larger cities in the region. Beginning in the 2000's, Erie's population grew at a tremendous rate, increasing from a population of 1,260 to 18,140 from 1990 to 2010 (US Census Data). Erie's growth was slowed by the economic slowdown that began in 2008, but as of the writing of the Plan, the local economy appears to be picking up again, and new home construction in Erie is occurring at rates similar to those seen before 2008.

The Town of Erie developed a Non-potable Water Master Plan in August, 2007 (the 2007 Plan, CDM 2007). The 2007 Plan was developed based on knowledge at the time of proposed future developments and potential for reclaimed water usage. It has been nearly seven years since the preparation of the 2007 Plan and the Town is aware of significant changes in land use, annexations, development and potable and non-potable water demands. Therefore, this revised Non-potable Water Master Plan (Plan) is an update and revision of the 2007 Plan.

Since the 2007 Plan, the Town has constructed the North Water Reclamation Facility (NWRF), located north of Highway 52 near County Line Road. The NWRF has the ability to treat wastewater to reclaimed water standards, and store the reclaimed water in a 1,000 AF reservoir at the NWRF and pump station with chlorination capabilities (the NWRF reservoir). The Town also constructed a 24-inch reclaimed pipeline from the NWRF to Highway 52. The pipeline continues from Highway 52 as a 16-inch reclaimed pipeline to the South Water Reclamation Facility (SWRF) located on the north end of Historic Erie, but has not yet been used to deliver reclaimed water to customers to date.

1.1 Objectives

The objectives of the updated Plan are:

- Update water supply portfolio and determine available water for non-potable system (Section 2)
  - include updates to the Town's water rights
  - include relevant terms of recent annexation agreements
  - Estimate non-potable water supply availability during dry, average and wet years

- Estimate demands for non-potable water (Section 3)
  - Utilize new mapping of proposed developments
  - Coordinate potential parks and rights-of-way demand with Town staff
  - Identify and estimate other potential non-potable water users, such as multi-family residential and commercial office parks,

- Develop an infrastructure layout based on the revised demand projections and potential coordinated operations between the reclaimed and non-potable ditch and C-BT supplies (Task 4)

- Model and describe non-potable system operations (Section 5)

- Prepare an opinion of probable costs for the system infrastructure proposed in Section 4 (Section 6) and discuss options for cost allocation

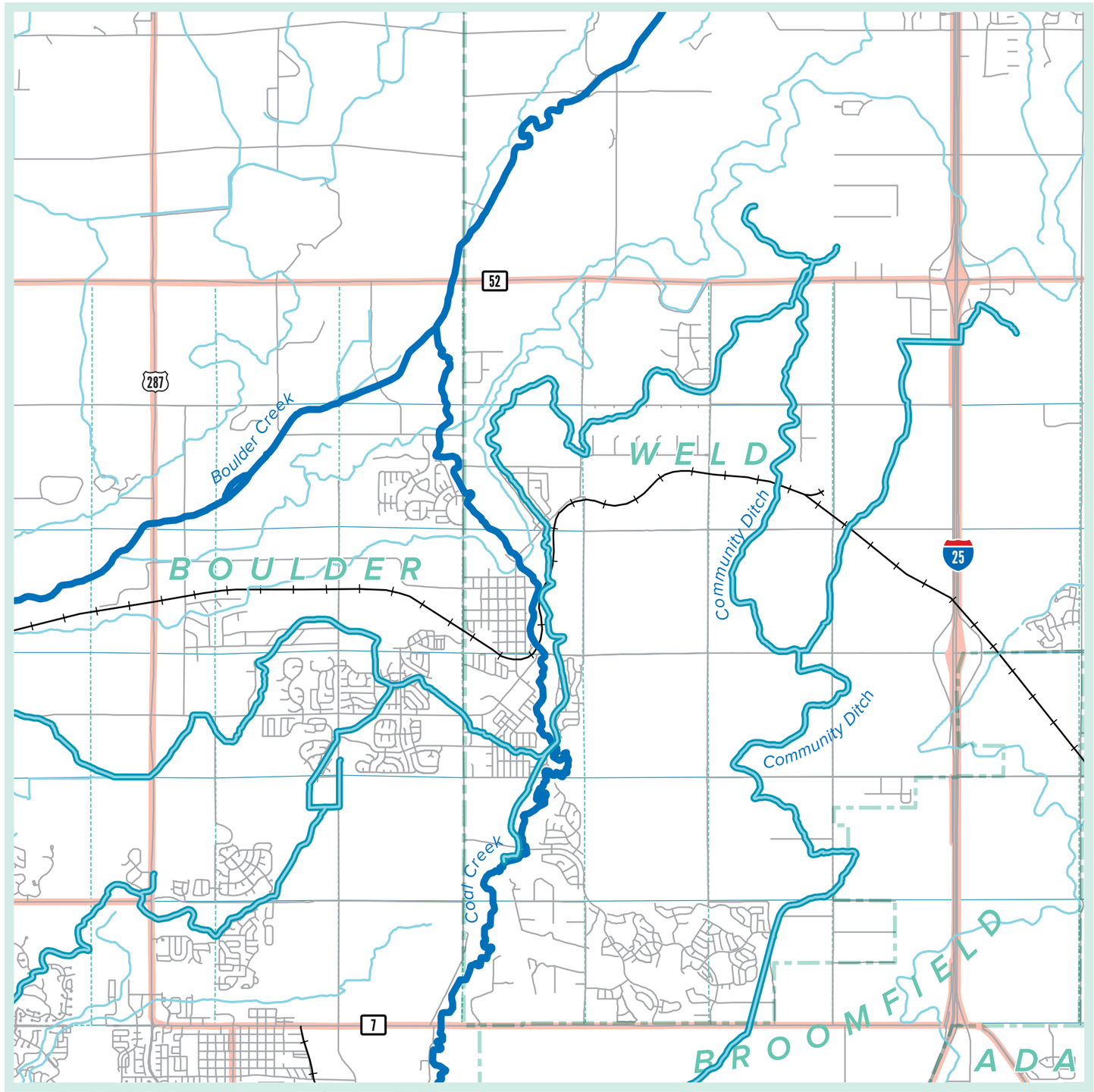
This Plan identifies areas that can be initially served by non-potable water in the short term to mid-term planning horizons. The Plan also identifies infrastructure to deliver non-potable water to these areas. This Plan does not constitute specific Town policy regarding non-potable use requirements for future developments and does not consider all possible future growth in Erie.

1.2 Background

The locations and types of development in Erie's service area affect water demand and seasonal patterns. The feasibility and cost of implementing a non-potable water system is affected by topography and the proximity of raw and reclaimed water supplies to areas of potential non-potable demands. Figure 1-1 shows a map of the Erie service area, which encompasses approximately 30 square miles, bounded approximately by Baseline Road (Colorado Highway 7) on the south, one and a half miles north of Colorado Highway 52 on the north, US Highway 287 on the west

figure 1-1.

Erie Service Area



LEGEND

- Coal and Boulder Creeks
- Canals with Erie Shares
- Highways
- Roads
- Railroad
- County Lines
- Section Lines

and Interstate 25 on the east. Historic Erie is located approximately in the center of this area, just east of the County Line road (Weld County Road 1).

1.2.1 Topography:

Coal Creek enters the Erie service area on the southern border and runs north through the middle of the service area, skirting the east side of Historic Erie and eventually flowing northward into Boulder Creek in the northern end of the service area. The land west of Coal Creek generally slopes gently down to the north and east towards Coal Creek except in the far northwestern corner of the service area where land slopes down northerly towards Boulder Creek. East of Coal Creek, the land rises quickly upwards from the creek and the upland area has gently rolling hills east to Interstate 25. The land east of Coal Creek within the Erie service area is at a higher elevation than Historic Erie.

The lowest point in the service area is located at the NWRF with an elevation of approximately 4,940 feet. The Town's highest point is located in the southeastern area of the service area, just north of the Colorado National Golf Course where an existing water tank is located (approximate elevation 5,330). The elevation difference between the NWRF and the SWRF is approximately 80 feet. From the SWRF to the high point is approximately 310 feet. Figure 1-2 shows cross sections taken along County Line Road (north-south) and Erie Parkway (east-west).

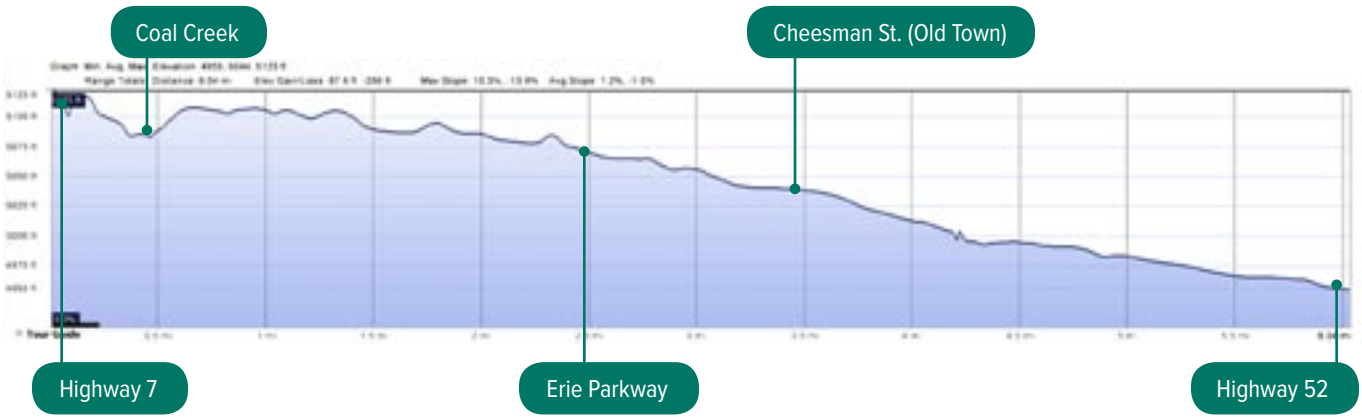
1.2.2 Current and Projected Land Uses:

Historic Erie was founded as a coal mining town in 1874 and encompasses approximately 200 acres near the center of the Erie service area. As Erie has grown in the past 15 years, lands that were historically agricultural lands (irrigated crops, dryland crops and pasture) have been converted into suburban neighborhoods. Much of the development has occurred to the west of Historic Erie, extending south and west to US Highway 287 and Arapahoe Road (e.g. Arapahoe Ridge). Development has also occurred south and north of Historic Erie (Erie Commons, Erie Village, Northridge) and to the east (Grandview, Bridgewater). Development has also occurred further to the south, including Vista Ridge, Vista Pointe and the Erie Airpark . Growth to the east of Historic Erie on the higher elevation areas has been slower than to the west. However, there are several proposed developments at different stages of planning or construction for this area and throughout the service area.

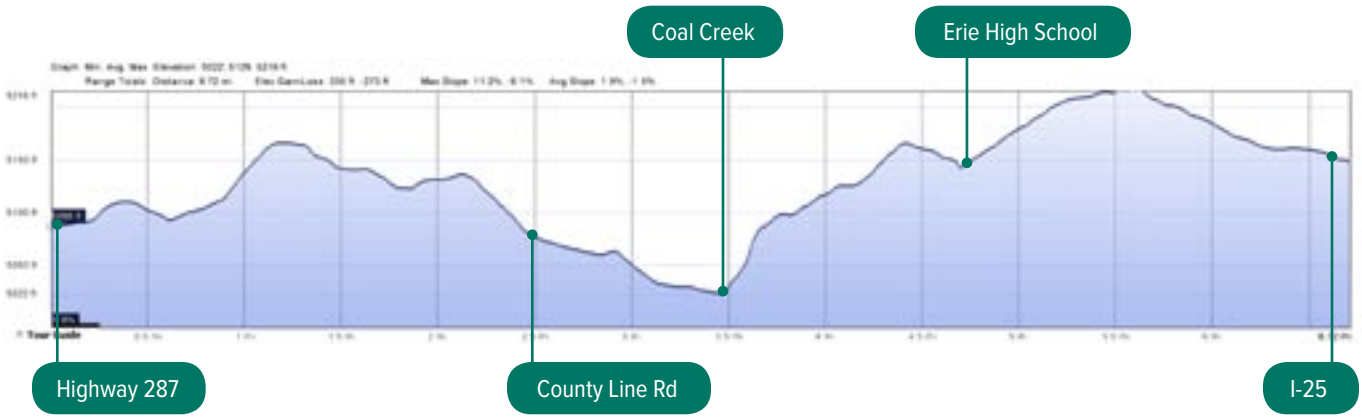
Much of the growth has been new residential development, with some retail and commercial development occurring on Highway 7 and on County Line Road and Erie Parkway near Erie Commons. Erie High School is located approximately a mile to the east of Historic Erie. There are several parks in Erie, including a large community park with the recreation center, library and several softball and athletic fields. Taken together, Erie parks

figure 1-2. Elevation Profiles Through the Erie Service Area

Erie South-North Cross Section along County Line Road



Erie West-East Cross Section along Erie Parkway



Cross sections generated in Google Earth

cover nearly 175 acres of the service area and the Colorado National Golf Course accounts for approximately 230 acres. In addition to the Erie Parks, there are substantial areas of open space along the Coal Creek corridor and Boulder County open space in the western half of the service area, particularly in the northwest corner of the service area near Boulder Creek.

Erie owns three reservoirs located in the southwest part of the service area (Erie Lake, Prince Reservoir No. 1 and Thomas Reservoir), a reservoir for storage of reclaimed water located at the North Water Reclamation Facility and a reservoir for storage of non-potable irrigation water located east of Erie Commons. Water is delivered from Erie Lake, Prince Reservoir No. 1 and Thomas Reservoir to the Lynn R. Morgan Water Treatment Facility (Morgan WTF). Several irrigation ditches traverse Erie, including the Leyner Cottonwood Ditch, Erie and Coal Creek Ditch, Community Ditch (Farmers Reservoir and Irrigation Company), South Boulder Canon Ditch, Lower Boulder Ditch, and the Boulder and Weld County Ditch. The ditches flow generally from southwest to northeast through the service area and are also shown on Figure 1-1. Erie owns shares in several of these ditches, as described in Section 2.

Figure 1-3 is a map of the service area that show projected future growth areas. Growth areas on specific parcels were identified through several meetings between Town and DWC staffs. The proposed growth parcels encompass a combined 6,200 acres. Figure 1-4 is a map of current land use zoning taken from the Erie Comprehensive Plan (updated 2010) that shows potential areas for development. Comparing Figures 1-3 and 1-4 shows areas, such as along the I-25 corridor, where there are not any specific development proposals at this time, but are included in the comprehensive plan for future development.

figure **1-3.**

Projected Future Growth Areas

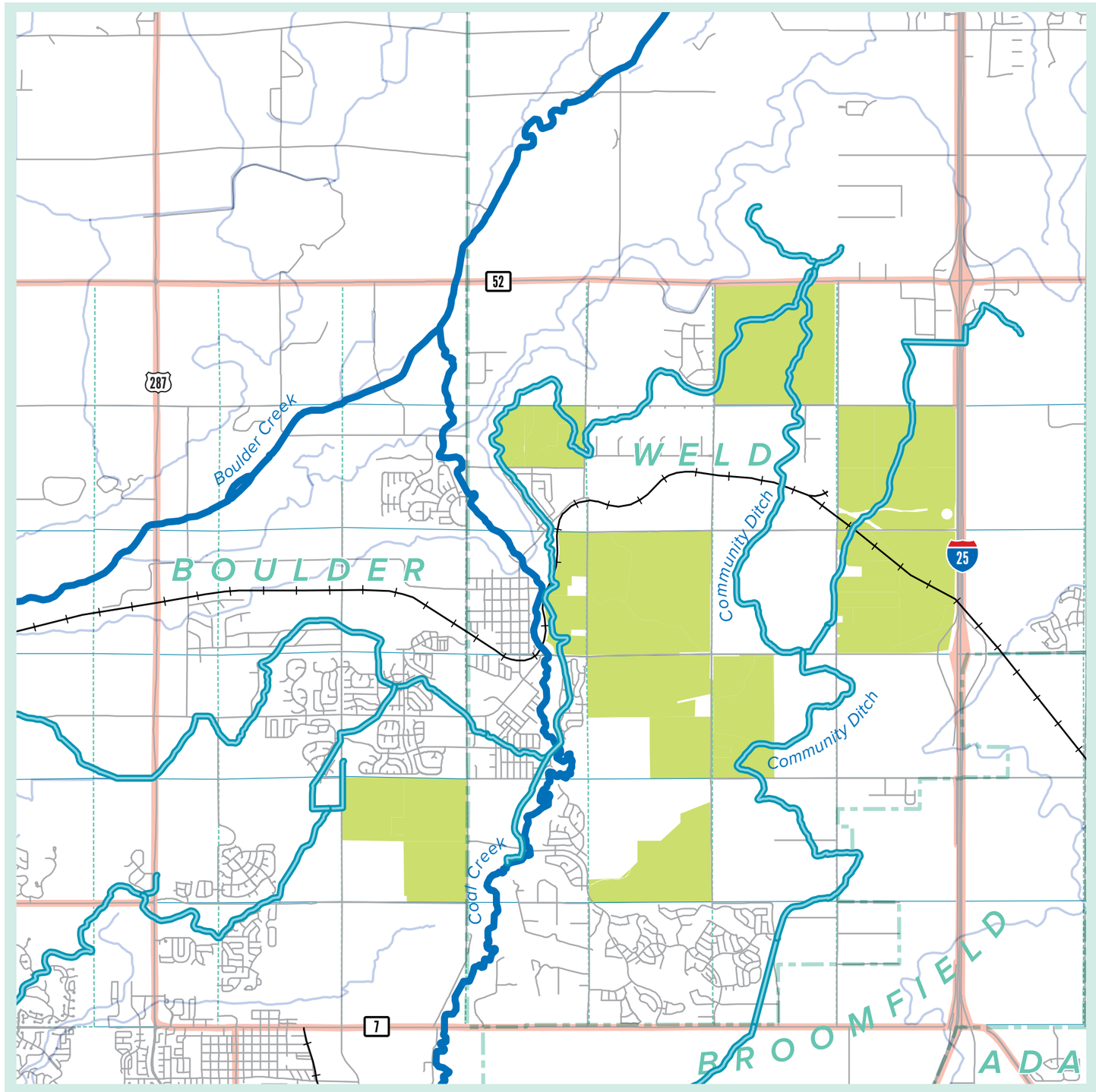
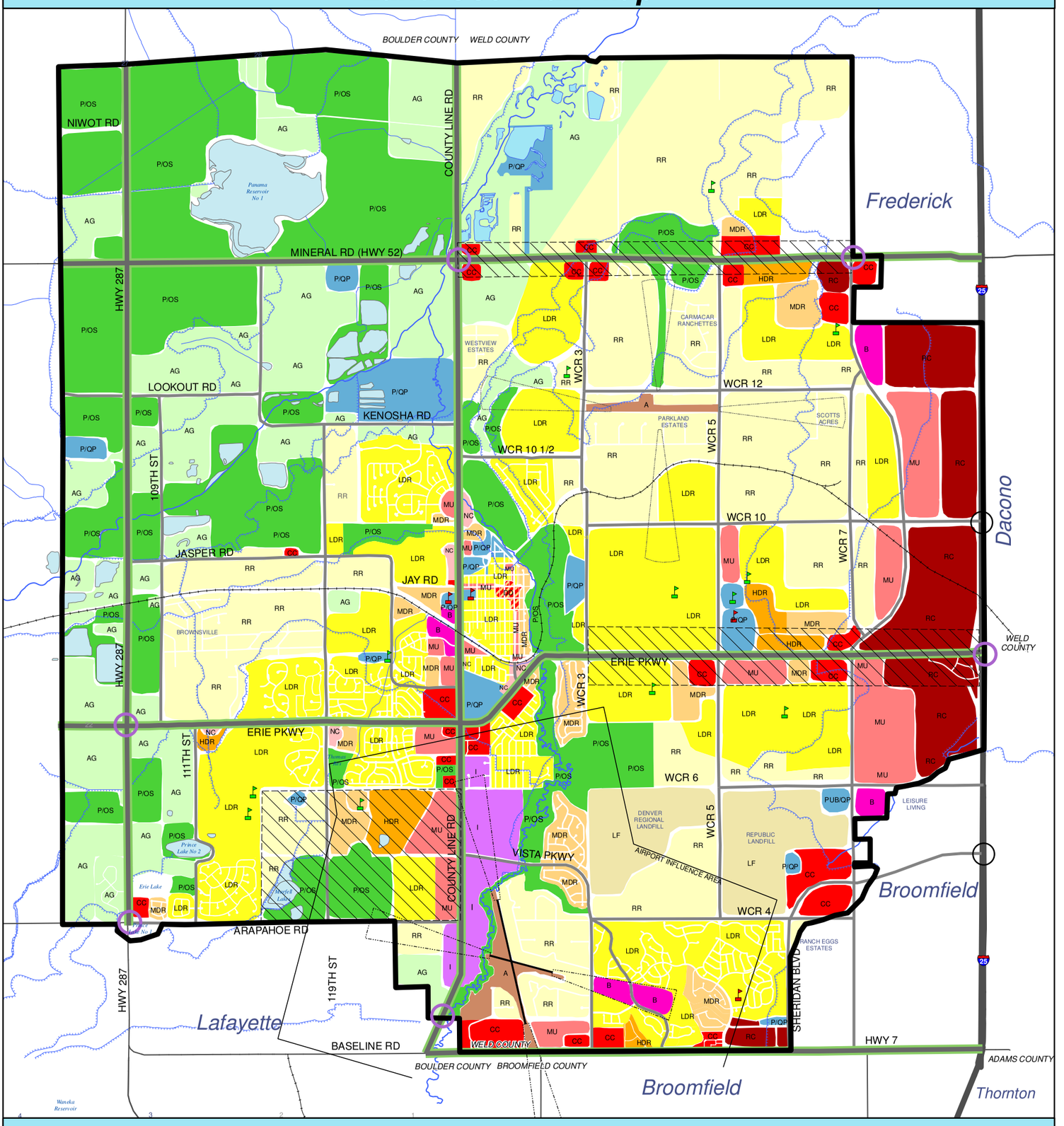


figure 1-4.

Town of Erie, Colorado
2005 Comprehensive Plan
Land Use Plan Map



Land Use Plan Legend

AG	Agriculture	MDR	Medium Density Residential (6-12 du/ac)	B	Business
P/OS	Parks/Public Open Space	HDR	High Density Residential (12-20 du/ac)	I	Industrial
P/QP	Public/Quasi Public	DD	Downtown District		Reservoirs
LF	Landfill	NC	Neighborhood Commercial		County Boundary
A	Airport	CC	Community Commercial		Planning Area Boundary
RR	Rural Residential (0-2 du/ac)	RC	Regional Commercial		Areas of Special Consideration
LDR	Low Density Residential (2-6 du/ac)	MU	Mixed Use		

Canal/Ditch
Railroad
Community Gateways
I-25 Interchange (Future)
Elementary School
Middle School
High School

0 0.25 0.5 1 Miles

Sources: Boulder CO GIS, Weld CO GIS, CDOT, Town of Erie

Note: This map is intended to serve as a guide for future land use patterns within the Town of Erie's Planning Area Boundary and is advisory in nature. Land Use patterns depicted on the map are generalized, recognizing that development proposals may contain a mixture of land uses and density levels which achieve the intent of the Town of Erie Comprehensive Plan. Adopted Date: Dec. 21, 2005.

The Comprehensive Plan contains guidelines for the refinement of the generalized areas depicted on the map. These guidelines should be referred to by applicants prior to the preparation of a development submittal and by Town staff, elected, and appointed officials as part of the development review process.

Town Boundary Not Shown - Refer to Zoning Map for Town Boundary

Map Revision Date: JULY 20, 2011

Section 2:
Water Supply and Infrastructure

Non-potable water is a term used in this Plan to describe water that is not treated to drinking water standards, but is acceptable for use for landscape irrigation. Water supplies such as Colorado-Big Thompson deliveries and irrigation ditch company shares that are not treated for potable purposes, but delivered directly for irrigation use are termed in this report as "raw water." Effluent from the Town's North Water Reclamation Facility (NWRF) that is treated to meet Colorado Department of Public Health and Environment reuse standards as defined in Regulation 84 is termed "reclaimed water" in this Master Plan. Both raw water and reclaimed water are non-potable supply sources that can be used to meet non-potable water demands.

Raw water: Untreated water supplies that can be delivered to a water treatment facility for treatment to potable standards or used directly for non-drinking water uses. For Erie, these raw water supplies include Colorado-Big Thompson, Windy Gap and Ditch shares.

Reclaimed water: Effluent treated to meet Regulation 84 standards. For Erie this is water that is treated at the NWRF to meet Regulation 84 standards.

Non-potable water: Water that is not to be used for drinking water or treated to drinking water standards. For Erie, this can be raw and/or reclaimed water.

Potable water: Water treated to meet federal Safe Drinking Water Act standards and is suitable for human water consumption. For Erie, this is water treated to drinking water standards and delivered from the Lynn R. Morgan WTF into the Town's potable water transmission system.

Erie's non-potable water demands are projected to be primarily for landscape irrigation. These water demands can be met with potable water or through a combination of raw (untreated) water and reclaimed water from its wastewater treatment plants (reclaimed water). Under Colorado water law, the ability to recapture and reuse return flows is determined by the source of the water. This section examines The Town's existing and future raw water supplies and existing uses of non-potable water.

Erie's primary water supply is derived from allotment contracts from the Colorado-Big Thompson (C-BT) project. In addition to C-BT water, Erie owns units of Windy Gap project water delivered through the C-BT infrastructure and is a participant in the Northern Integrated Supply Project (NISP) that would deliver additional water from the South Platte

basin through the C-BT infrastructure. Erie also owns shares in several ditch companies that traverse the service area, including ditches that continue to provide irrigation water to agricultural lands inside and outside of the Erie service area.

The amount of water supply varies significantly from year to year based on a number of factors described in further detail below. Due to the variability in raw water supplies, Erie has the ability and opportunity to meet its non-potable demands from a variety of sources, including a combination of reclaimed and raw water. This has the potential benefits of providing a

Table **2-1.** Erie Water Sources

NCWCD Water Supply Inventory Form
Water Supplier: Town of Erie
Updated: January 6, 2014

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Avg. Annual Yield (af)	Dry Yr. Annual Yield (af/sh)	Dry Yr. Annual Yield (af)	Firm Annual Yield (af/sh)	Firm Annual Yield (af)
Transbasin Sources CBT Project							
Total units owned	3430						
Erie Financial Corp. Lease/Purchase)	3900						
Variable quota	7380	0.7	5166	1	7380	0.5	3690
Windy Gap Project							
Units Owned	14	100	1400	0	0	0	
Reservoir Storage							
Erie Reservoir	239	1	239	0.3	71.7	0.3	0[2]
Prince Reservoir	80	1	80	0.3	24	0.3	0[2]
Thomas Reservoir	148	1	148	0	0	0	
Mutual Irrigation Company Ownership							
Leyner Cottonwood Ditch	311.5	0.54	168.2	0.21	65.4	0.21	65.4[3]
South Boulder Canon Ditch[1]	205	2.9	594.5	0	0	0	0
Erie Coal Creek Ditch and Res. Co.	98	4.9	480.2	0.56	54.9	0.56	54.9[3]
FRICO – Marshall Lake Div.	8.24	4	33	0.5	4.1	0.5	4.1[3]
Total			**8340.8**		**8000.1**		**3814.1 Total 3690 Potable**

[1] 2 shares owned by Town of Erie Urban Renewal Authority

[2] Based on 2012 Water Year

[3] These water rights are decreed for irrigation use, except 155 shares in the Leyner Cottonwood Ditch. The Leyner Cottonwood water needs to be diverted through the South Boulder Canon Ditch to be used for potable purposes, which is not possible in years when the South Boulder Canon Ditch is not diverting under its own priorities.

robust system with some level of redundancy, lowering operational costs through reduced pumping when raw water is available, and flushing salts from areas irrigated with reclaimed water when raw water is available.

Table 2-1 provides a summary of the Erie water supply, including estimated average and dry-year yields. The water supplies shown in Table 2 are currently used to meet both potable and non-potable demands in Erie. A discussion of each water source, including annual variability, limitations on non-potable and reclaimed, and potential for non-potable use follows the table.

2.1 C-BT Water

Erie's current primary source of water is the Colorado-Big Thompson Project (C-BT). The C-BT project is operated by the Northern Colorado Water Conservancy District (Northern Water) and diverts water from the west slope near Granby, Colorado, and through a series of pumps, tunnels, reservoirs and pipelines, delivers this water to thousands of agricultural, municipal and industrial water users on the Front Range of northern Colorado. Erie is a participant in Northern Water's Southern Water Supply Pipeline and owns firm capacity of 5.5 cubic feet per second (cfs). This pipeline can deliver C-BT and Windy Gap water from Carter Lake (a C-BT reservoir located near Loveland) directly to the Erie water treatment plant. In 2009, Erie constructed an additional 36-inch raw water pipeline and pump station that diverts water out of the Boulder Supply Canal which canal receives C-BT and Windy Gap water released from Boulder Reservoir, a C-BT reservoir located northeast of Boulder. This pipeline conveys raw water to Erie and Prince Reservoirs located near the corner of Arapahoe Avenue and US Highway 287. From these reservoirs, the water is conveyed via pipeline to the Erie water treatment plant. This 36-inche Erie pipeline has a capacity of 20 cfs.

Each spring, Northern Water sets an annual quota for its system. The quota is a percentage that has historically ranged from 50 percent to 100 percent with an average of 70 percent. Each C-BT unit is allocated 1 acre-foot (AF) of water multiplied by the quota. For example, in a 70 percent quote year, each C-BT unit is allocated 0.7 AF of water. The C-BT system was originally designed to be a supplemental water supply and as such, the quota is generally set lower in wet year, and higher in dry years. This variability tends to smooth out a water user's total annual supply between wet and dry years if native water makes up a significant part of the overall water portfolio. In extremely dry years, Northern Water has set a quota as low as 0.5 acre feet due to low water availability for the C-BT system on the West Slope.

As shown in Table 2, Erie owns allotment contracts for 7,380 C-BT Units, which will provide Erie with between 3,690 AF of water per year at a 50 percent quota and 7,380 AF of water with a 100 percent quota. In an average year, a 70 percent quota provides Erie with 5,166 AF of water. In addition to the water available under the annual quota, Northern Water currently operates a C-BT carryover program that allows C-BT unit holders to store a portion of any unused C-BT water into the next year. The carryover program limits the total amount carried over to 20 percent of full supply (100 percent quota), subject to a 10 percent shrink charge on the water carried over to account for evaporation and seepage. (Northern Water 2004) According to Erie's water attorney, Erie has utilized the carryover program every year.

C-BT units allot a water user the first use of the water. Return flows from C-BT must remain in the stream system for the benefit of other water users in the Northern Water district boundaries and cannot be used for augmentation purposes except under limited circumstances. Due to this limitation on C-BT use, treated wastewater effluent from C-BT sources cannot be used in Erie's reclaimed water system and must be discharged to the stream, and cannot be used for augmentation of any well pumping or changed water rights return flow obligations.

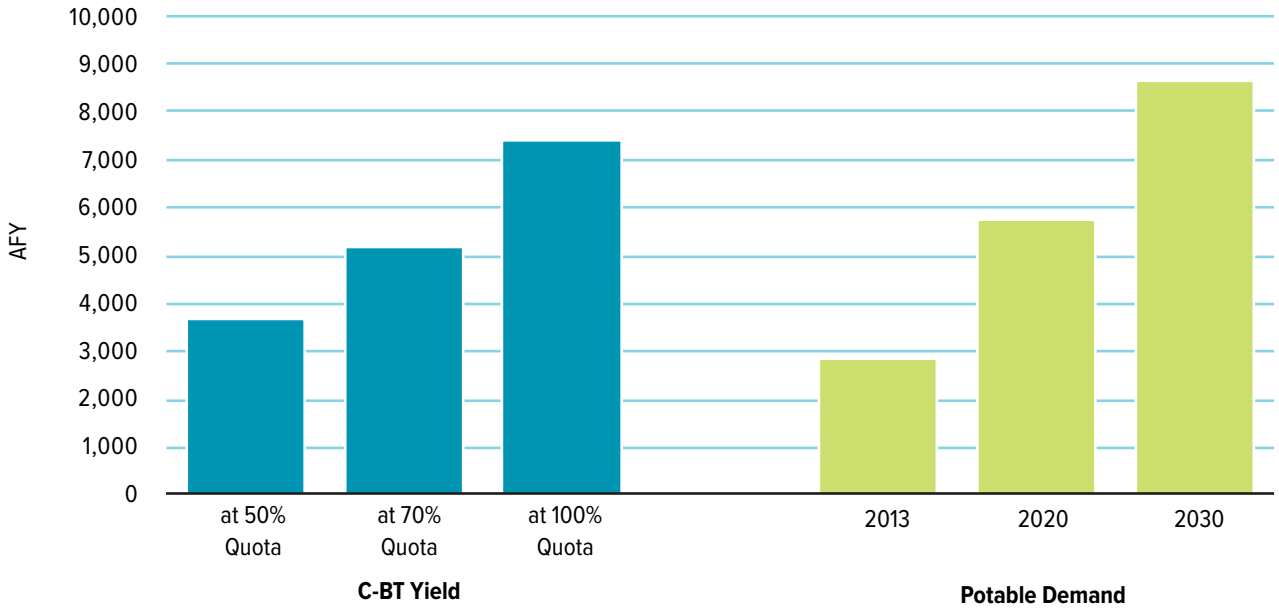
The amount of water consumed (lost to evaporation or evapotranspiration) in the first use of water for a municipal system varies seasonally. In the summer, consumption of water is higher due to consumption by vegetation as a result of outdoor watering and less than half of the water delivered to water users returns to the wastewater treatment plant. In the winter months, approximately 95 percent of water delivered to customers returns to the wastewater treatment plant. By using reusable water sources in the winter, Erie can maximize the volume of reusable water stored at the NWRF Reservoir for use the following irrigation season in its reclaimed system.

Erie can use C-BT water for non-potable use, but due to the high quality and delivery location of C-BT units to the Lynn R. Morgan WTF, C-BT would be used to fulfill demand in potable system before water is allocated to non-potable uses. In high quota years, there is currently enough C-BT water to meet the potable demand and the non-potable demand. However, in low quota years, the current C-BT supply is needed fully in the potable system and available sources of other water should be used in the non-potable system, such as reclaimed water or ditch water that has not been converted to municipal use.

As Erie grows and the demand for potable water increases, the Town will not be able to rely on C-BT for non-potable uses with the same frequency it does now. Figure 2-1 shows the 2013 potable water use and projected potable water demands in 2020 and 2030* compared to C-BT supply under

* Projections from NISP DEIS Harvey Economics (2011), Exhibit D-7. Demands includes 13% transmission, treatment and distribution loss

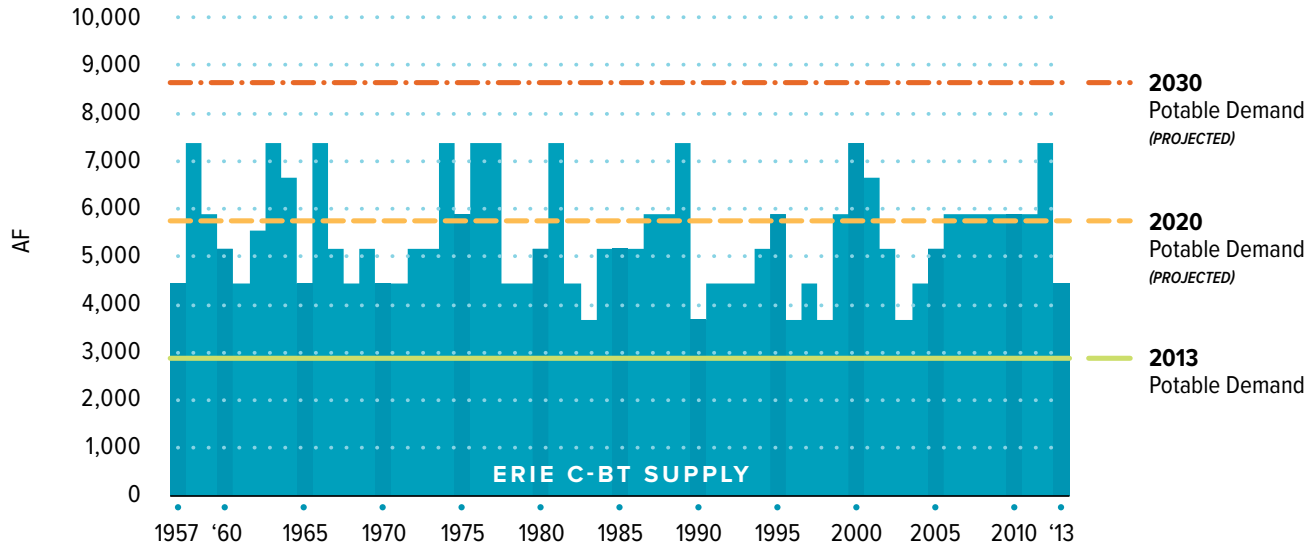
figure **2-1.** C-BT Yield and Projected Potable Demands



different C-BT quotas. Surplus C-BT water can be leased by the Town to other water users, carried over in the Northern Water system, or used for non-potable uses. The figure shows that 2013 potable demand cannot be fully met with C-BT water under a 50 percent quota alone. However, at a 70 percent quota, there is currently approximately 1,200 AF of surplus C-BT water, and at a 100 percent quota, there is approximately 3,400 AF of surplus C-BT water. As demands increase, the amount of surplus C-BT water will decrease, and by 2020, the average C-BT quota of 70 percent will not provide sufficient water to meet the potable demand, and by 2030 a C-BT quota of 100 percent will not meet the potable demand. As a result, Erie cannot rely solely on its current levels of C-BT to meet future potable demands, and therefore may not be able to rely on C-BT as a supply for any non-potable demands.

The water year for the C-BT Project is November 1–October 31. The initial C-BT quota is usually set in November, but can be revised later by the Northern Water Board of Directors if warranted based on water supply conditions. That way, municipal providers that rely on C-BT water through the winter can use a portion of their C-BT supply prior to the water supply forecasts based on the winter snowpack. Figure 2-2 shows the historical C-BT quota applied to the number of Erie's current C-BT units, and the 2013, 2020 and 2030 demand levels.

figure **2-2.** Historical C-BT Quota Applied to Current Number of Erie C-BT Units



2.2 Windy Gap and NISP Water

Erie currently owns 14 Units of the Windy Gap Project water, which in average years yields 1,400 AF of water. The Windy Gap project diverts water from the Colorado River and conveys water to the Front Range using excess capacity in the C-BT system. Unlike C-BT water, this water can be used and reused to extinction including use for augmentation. Due to capacity restrictions in the C-BT system and the relative junior priority of Windy Gap Project water rights on the Colorado River, there are years where the Windy Gap project does not currently yield any water. To mitigate this situation, Northern Water has implemented a program known as the Cooperative Regional Agreement whereby an entity with C-BT water can provide C-BT water as collateral for Windy Gap water. In addition, the Windy Gap Firming Project, currently in the federal permitting process, proposes to build a new reservoir that would firm the Windy Gap yield and make deliveries in all years, even if no Windy Gap water can be delivered from the west slope in a given year. The Windy Gap Firming Project would provide Erie with a reliable yield of approximately 1,200 AFY of Windy Gap water.

Erie is also a participant in the Northern Integrated Supply Project (NISP), which is also currently in the federal permitting process. NISP would provide Erie with 6,500 AFY of water, a portion of which can be used and reused to extinction. If permitted, NISP deliveries may utilize the existing east-slope C-BT facilities or a pipeline from northern Colorado, depending on which alternative is approved.

Erie can use its Windy Gap and NISP water to meet a first use through the potable system and capture the reusable wastewater effluent for reuse. By using this water in the winter months, the amount of water consumed through the first use is small compared to using this water in summer months, and nearly 95 percent of the first use water returns to the wastewater treatment plant where it can be treated and stored for subsequent reuse. Windy Gap and NISP water can also be used in the summer, but much more of the water is consumed through outdoor watering. Because Windy Gap and NISP are reusable supplies, Erie increases its reusable water supply by using Windy Gap and NISP in the winter.

2.3 Ditch Water Rights

Several irrigation canals are located within the Erie planning area, and Erie owns shares of several of these ditch companies (Table 2-1). The combined average yield from these ditches is 1,276 AF, but the dry-year yield drops significantly to only 124 AF. The majority of the Town's ditch shares are decreed for irrigation and have not been changed for municipal use. Shares decreed for irrigation generally may only be used to irrigate areas that were decreed to be irrigated or historically irrigated under that ditch. The use of these ditch shares for non-potable irrigation is advantageous because the water rights do not have to be changed in water court if used within the historical ditch service areas.

Erie changed 155 shares in the Leyner Cottonwood Ditch to municipal use, but this water must be diverted through the South Boulder Canon Ditch to be used for potable uses, because the Leyner Cottonwood Ditch cannot deliver water by gravity to the Erie potable supply reservoirs or Lynn R. Morgan WTF. The South Boulder Canon Ditch diverts from South Boulder Creek upstream of the Leyner Cottonwood diversion point and can deliver water by gravity to the Erie reservoirs and WTF. The Leyner Cottonwood is senior to the South Boulder Canon Ditch, so at times when Erie's Leyner Cottonwood shares are in priority, the South Boulder Canon Ditch may not be in priority, and there would be no flow in the South Boulder Canon Ditch. Erie has a carriage agreement with South Boulder Canon Ditch, but at times when that ditch is not diverting in priority, the Erie shares of Leyner Cottonwood would be lost to ditch conveyance losses before reaching the Erie reservoirs.

Figure 2-3 shows the location of the ditches in which Erie owns shares, and the areas where this water can be used within the Erie service areas. The map shows that Community Ditch service area covers a large portion of the eastern Erie service area. The South Boulder Canon can serve most parts of the southwest Erie service area and the Leyner Cottonwood Ditch could provide irrigation water to the central parts of Erie, including Erie

Commons and Historic Erie. The Erie and Coal Creek ditch could irrigate a small strip of the greenway area on the east side of Coal Creek through Historic Erie and parts of the northern service area, including portions of the proposed Summerfield and Morgan Hill developments (see Figure 2-3).

Erie is the majority shareholder in the Erie and Coal Creek Ditch, and also owns the lower section of the Leyner Cottonwood Ditch from where it enters Town limits to its eastern terminus near Coal Creek.

2.4 Annexation Agreements

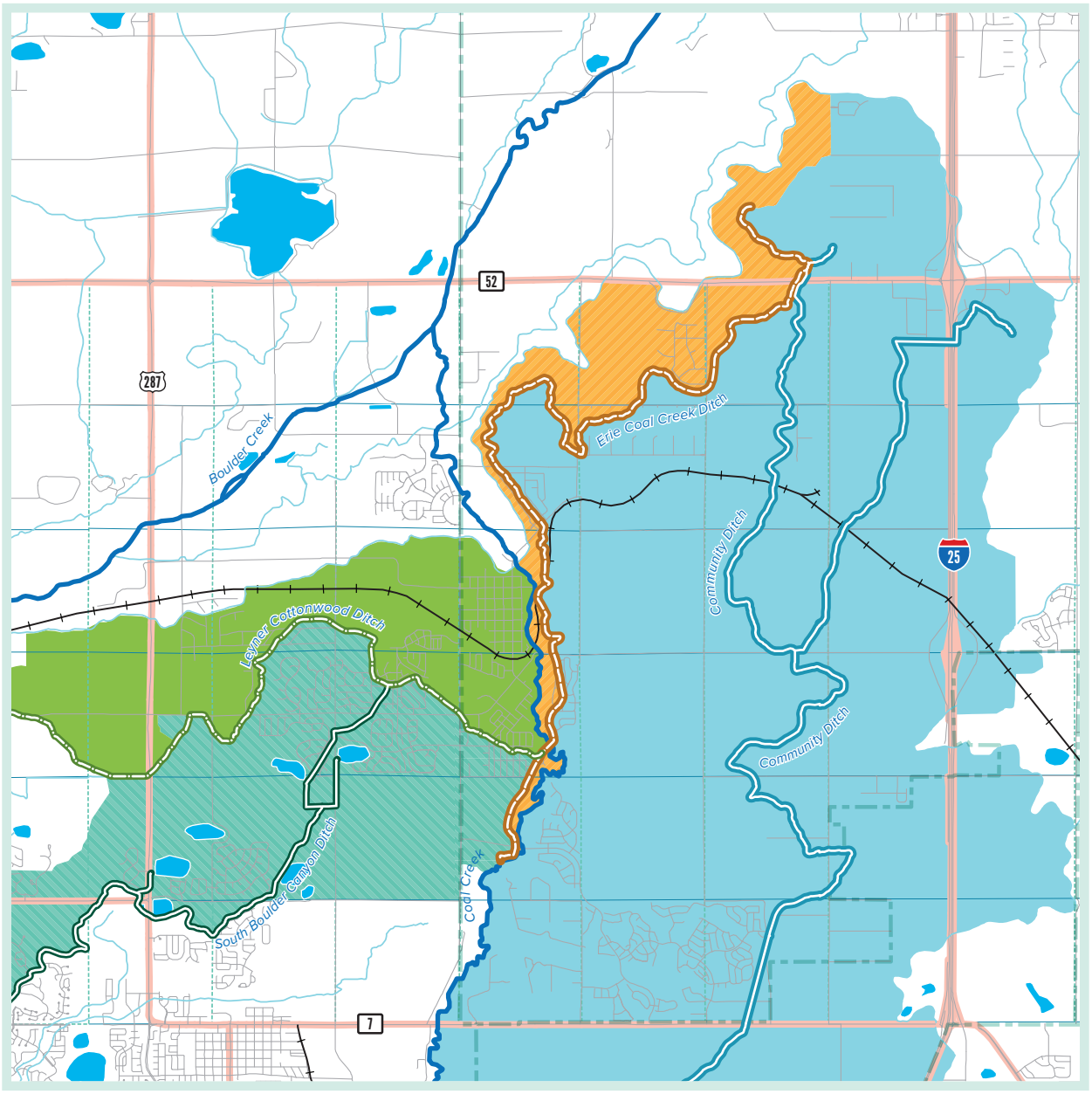
Erie provided DWC with annexation agreements from two major developments proposed for Erie. The first is the Bridgewater Development, located just east of Historic Erie. The second is for Summerfield, located in the northeast portion of the Erie service area. The annexation agreements include provisions for water supply and reclaimed water infrastructure and supply. The following are key components of these annexation agreements:

- The Bridgewater developer agreed to the following with respect to the non-potable water system:
  - Service to parks, open space and arterial rights-of-way
  - Annual demand estimated at 120 AF per year of non-potable water
  - Developer will submit a non-potable irrigation plan
  - Developer will pay Town $1,000,000 for reuse water rights
  - Dedication of water rights for non-potable use, including Leyner Cottonwood shares. Erie and Coal Creek Ditch shares, Lower Boulder, Community Ditch, FRICO, C-BT or other water rights

- The Summerfield developer agreed to the following with respect to the non-potable water system:
  - Service to parks, open space and arterial rights-of-way
  - Annual demand estimated at 72 AF per year of non-potable water
  - Developer will submit a non-potable irrigation plan
  - Developer will pay Town $600,000 for reuse water rights
  - Dedication of water rights for non-potable use, including Leyner Cottonwood shares. Erie and Coal Creek Ditch shares, Lower Boulder, Community Ditch, FRICO, C-BT or other water rights

- Construction of 8-inch reclaimed water line from existing line in SH-52

figure **2-3.** Location of Ditches in which Erie Owns Shares and Historical Ditch Service Areas



LEGEND

Ditches & Waterways
- Community Ditch
- Erie Coal Creek Ditch
- Leyner Cottonwood Ditch
- South Boulder Canyon Ditch
- Coal and Boulder Creeks

Ditch Service Areas
- FRICO/Marshall Lake
- Erie Coal Creek Ditch Co.
- Leyner Cottonwood Consolidated
- South Boulder Canyon Ditch

- Highways
- Roads
- Railroad
- County Lines
- Section Lines

These annexation agreements contemplate that Erie will continue development of its reclaimed system as new developments are proposed. The Bridgewater development is currently under construction and the Town and developer are jointly designing the extension from the SWRF south to the development. The projects are shown on Figure 1-3, with Bridgewater located in Section 17 east of Historic Erie, and Summerfield located in Section 4 in the northeastern portion of the service area.

2.5 Reclaimed Water

The use of reclaimed water is more heavily regulated than the use of raw water sources. The Colorado Department of Public Health and Environment Regulation No. 84 is the governing regulation for the control of reclaimed water (CDPHE 2013). Levels of some contaminants are higher in reclaimed water than in raw or potable sources as a result of the initial use by customers within the potable system and collection and treatment wastewater treatment facilities. There are three classifications of reclaimed water under Regulation 84 with increasingly strict treatment standards. Erie's reclaimed water treatment system at the NWRF is capable of treating to Category 2. Category 2 reclaimed water from Erie's NWRF "shall, at a minimum, receive secondary treatment with filtration and disinfection" and not exceed 126/100ml monthly geometric mean and 235/100 ml single sample maximum for *E. coli*. Turbidity is not to exceed 3 NTU on a monthly average and not to exceed 5 NTU in more than 5 percent of the individual analytical results during any calendar month.

Table 2-2 provides the approved uses under Regulation 84 (Section 84.8, Table A). Additional conditions are required with various uses. For landscape irrigation, the additional condition Number 3 states that water "application rates or other measures shall be employed to minimize ponding on or runoff from the area approved for application or use." Additional conditions numbers 4 and 5 have to do with restricting access to reclaimed water piping near and within residences. Since Erie does not intend to use reclaimed water on individual lots, these provisions would not apply.

Regulation 84 also specifies required application (letter of intent) terms and conditions from CDPHE specific to the intended uses, reporting and monitoring requirements for reclaimed water, including location and amounts of reclaimed water used, and for landscape irrigation, there are several provisions regarding appropriate signage to inform the public not to drink the reclaimed water, appropriate markings on pipes, valves and sprinkler heads (e.g. purple pipes), and a variety of preventative measures to counter potential cross-connections with the potable system.

Table **2-2.** Approved Uses of Reclaimed Water under Regulation 84

Approved Uses	Category 1	Category 2	Category 3	Additional Conditions Required 84.8(A)
Industrial				
Evaporative Industrial Processes	Allowed	Allowed	Allowed	1
Washwater Applications	Not Allowed	Allowed	Allowed	2,3,7
Non-Discharging Construction and Road Maintenance	Allowed	Allowed	Allowed	3,7
Non-Evaporative Industrial Processes	Allowed	Allowed	Allowed	7
Landscape Irrigation				
Restricted Access	Allowed	Allowed	Allowed	
Unrestricted Access	Not Allowed	Allowed	Allowed	3,4
Resident-Controlled	Not Allowed	Not Allowed	Allowed	3,4,5
Commercial				
Zoo Operations	Allowed	Allowed	Allowed	
Commercial Laundries	Not Allowed	Allowed	Allowed	7
Automated Vehicle Washing	Not Allowed	Allowed	Allowed	3,8
Manual Non-Public Vehicle Washing	Not Allowed	Allowed	Allowed	3,8
Fire Protection				
Nonresidential Fire Protection	Not Allowed	Allowed	Allowed	6
Residential Fire Protection	Not Allowed	Not Allowed	Allowed	6
Agricultural Irrigation				
Non-Food Crop Irrigation and Silviculture	Allowed	Allowed	Allowed	3

Regulation 84 does not specify times of day that reclaimed water can and cannot be used. However, individual use permits may specify times that reduce exposure to the public, normally at night. Table 2-2 indicates that Category 2 reclaimed water can be used on landscape irrigation with unrestricted access. However, due to potential negative public perception of reclaimed water and as a precautionary policy, the daily irrigation schedule developed for this plan assumes that reclaimed customers will irrigate during a 10-hour nighttime period to minimize the potential human contact with the reclaimed water.

The regulatory requirements for reclaimed water may require additional staff to appropriately monitor and prepare the required reports, as well as dealing with other potential issues associated with reclaimed water, such as overspray and residue on cars, siding, and windows.

Raw water and potable water are not subject to the same regulatory requirements as the reclaimed system. Parks and medians that can be served off the raw water system without a connection to the reclaimed

system can avoid Regulation 84. However, the non-potable system can operate more reliably by taking advantage of the raw water and reclaimed water sources, and by eliminating the need to provide a potable water tap at these locations as a back-up supply.

Reclaimed water has a higher level of total dissolved solids (TDS) than the source of the first-use water. In general, reclaimed water has TDS of approximately 250 mg/L higher than the initial potable water supply. The additional salinity of reclaimed water can negatively impact certain types of plants. The periodic use of raw water on areas irrigated with reclaimed water can serve to flush salts from the soil that can accumulate over time.

Section 3:
Non-Potable Water Demands

Non-potable demands associated with landscape irrigation of residential areas, medians, parks, and commercial, and industrial areas are expected to comprise a significant portion of Erie's overall water demands. The Master Plan focuses on cost-effective opportunities to supply these demands with non-potable supplies. Irrigation of single family residential lots is recommended to continue to be supplied with potable water. The distribution system costs and operational issues associated with dual distribution systems makes this option significantly more costly than the irrigation of major residential common areas, medians, parks and commercial and industrial areas.

This section describes the current use of non-potable water and the method used to project potential non-potable demands throughout the service area. Monthly and annual potential non-potable water demands were projected for current and future land uses. Erie's non-potable demands were previously projected in the 2007 Plan and in the NISP DEIS. Updated estimates of non-potable demands presented in this section are compared with the previous projections (see Section 3.3).

3.1 Current Use of Non-Potable Water

Erie currently delivers untreated raw water (non-potable water) directly to Lehigh Park in Erie Commons, adjacent rights of way within Erie Commons, and the Erie Community Park and Recreation Center turf area. It also supplies non-potable water via exchange from Coal Creek to serve the Colorado National Golf Course and Columbine Mine Park in the Vista Ridge subdivision. Erie uses its Leyner Cottonwood shares and in addition delivers untreated C-BT water through a ditch system into the Leyner Cottonwood Ditch, which is then delivered to a small pond located near Coal Creek, southeast of Erie Commons. Erie has purchased that portion of the Leyner Cottonwood Ditch. Water from the pond is pumped to Erie Commons (Lehigh Park and rights-of-way) and Erie Community Park for irrigation. In addition to the pipelines used to transmit water from the pond to the parks, there are two 6-inch lines located on the either side of Coal Creek between the irrigation pond and Erie Parkway. The eastern line extends farther north to Erie Parkway, and crosses back to the west side of Coal Creek just south of Erie Parkway. These lines were used to establish native vegetation in the area adjacent to the creek but are not currently

used since the vegetation has been established. These pipes may provide a temporary means to connect the irrigation pond to the proposed extension of the reclaimed line from the SWRF (see Section 5).

Outdoor water use data for 2012 were obtained from Erie staff. Non-potable water is delivered to Erie Community Park, Erie Community Center, Lehigh Park, and Columbine Mine Park. The combined non-potable water use for these three areas in 2012 was 32 million gallons or 99 AF. This was used to irrigate 28.6 acres of bluegrass and equates to 41.8 inches of water applied. In comparison, Erie's use of potable supplies at other parks was less than at the non-potable parks. At parks with a potable supply, Erie irrigated 31.2 acres of bluegrass with 24 million gallons, which is 28.6 inches applied. The cost of water to the Parks department for potable water is $6.01 per 1,000 gallons, while non-potable is $0.63 per 1,000 gallons. Erie staff provided the acreage of bluegrass in each park, and a GIS dataset with the area of the park parcels. Table 3-1 shows the water use by park for 2012, the application rate for bluegrass acreage, the gross water application rate based on the size of the park parcel, and an estimated demand based on a target application of 30 inches per year to bluegrass areas. Table 3-1 shows that total water use on parks of 174 AF is about 25 AF higher than what would be required using a 30 inch application target on bluegrass. The higher actual use is likely due to watering of lower water demand areas, such as shrubs, trees and flower beds that are not accounted for in the bluegrass acreage.

In 2012, Erie delivered approximately 300 AF of reusable effluent to Boulder Creek at its NWRF allowing Colorado National Golf Course to divert upstream via exchange a similar amount from Coal Creek at its pump station located just north of the Vista Parkway bridge where it crosses Coal Creek. Water diverted at Coal Creek was used to irrigate the golf course and Columbine Mine Park. The golf course has also used water from the Community Ditch (FRICO), which enters the golf course near its highest point on the east.

Erie constructed a 1,000 AF reclaimed reservoir at the NWRF (NWRF Reservoir) and reclaimed line from the NWRF to the SWRF. The NWRF reservoir can store reclaimed water treated in the winter for delivery the following irrigation season and can provide regulatory storage throughout the year. The reclaimed line is a 24-inch diameter line from the NWRF to Highway 52. At Highway 52, the pipe reduces to a 16-inch line to the SWRF. The pump station located at the NWRF can pump reclaimed water to the highest point in the Bridgewater development, located approximately 150 feet higher in elevation than the SWRF, and 225 feet higher than the NWRF. The reclaimed line has not yet been used to deliver reclaimed water, but design is underway to extend this line to the new Bridgewater development, just east of Historic Erie.

Table **3-1.** 2012 Water Use on Erie Parks

Park	Water Source	Acres Bluegrass[2]	2012 Water Use (gallons)[2]	2012 Water Use (AF)[2]	Application Rate on Bluegrass (inches)[3]	Park Parcel Acreage	Application Rate on Park Parcel Size (inches)	Annual Demand Based on 30-inch application to Bluegrass (AFY)
Erie Community Center	Non-Potable	3.1	2,876,000	8.8	34.3	4.8	22.0	7.7
Erie Community Park[1]	Non-Potable	14.2	17,024,500	52.2	44.1	44.2	14.2	35.6
Lehigh Park	Non-Potable	5.0	7,184,745	22.0	53.4	7.5	35.5	12.4
Columbine Mine Park	Non-Potable	6.3	5,341,000	16.4	31.3	8.9	22.2	15.7
Total Non-Potable		**28.6**	**32,426,245**	**99.5**	**41.8**	**65.3**	**18.3**	**71.4**
Arapahoe Ridge	Potable	5.1	4,216,845	12.9	30.7	5.5	28.5	12.6
Coal Creek	Potable	4.1	2,429,838	7.5	22.1	6.5	13.8	10.1
Coal Miners	Potable	0.3	331,931	1.0	45.6	0.6	21.9	0.7
Country Fields	Potable	5.2	4,638,163	14.2	33.1	10.5	16.2	12.9
Crescent	Potable	6.3	4,832,065	14.8	28.1	7.7	23.0	15.8
Longs Peak	Potable	7.6	5,749,047	17.6	27.9	9.1	23.2	19.0
Reliance	Potable	2.8	2,058,331	6.3	27.6	4.8	15.8	6.9
Total Potable[4]		**31.2**	**24,256,220**	**74.4**	**28.6**	**44.7**	**20.0**	**78.0**
Total Parks Use		**59.8**	**56,682,465**	**174.0**	**34.9**	**110.0**	**19.0**	**149.4**

[1] Erie Community Park includes ballfield acreage

[2] Data provided by Erie staff

[3] Calculated as total water use, applied to Bluegrass only and does not account for lower water use areas such as shrubs or flower beds

[4] Erie also uses potable water to irrigate the Leon Wurl service center, Thomas Reservoir area and Town Hall, totalling approximately 3.5 million gallons per year

3.2 Future Non-Potable Water Demands

Non-potable water can be used for irrigation of parks, medians, commercial development landscaping, and larger common areas found in some multi-family housing developments. Non-potable water use does not require water to be treated to meet potable water quality standards, and thereby avoids costly water treatment capital, operating and maintenance costs. However, a separate non-potable water system requires duplication of distribution infrastructure, which is costlier than oversizing the potable system to meet the same demands. Reclaimed water within the non-potable system extends an existing water supply by allowing for a second use of the water. The use of reclaimed water may require a higher level of treatment of wastewater than would be required if the wastewater effluent were discharged to a stream. However, along the front range of Colorado, water

supply sources are sufficiently scarce to provide financial incentive for many water providers to invest in a non-potable distribution system instead of the expense and uncertainty associated with acquisition (and if necessary change of use through water court) of additional water rights.

Future non-potable demands were estimated by evaluating existing areas that could be economically served by non-potable water, and by estimating future demands within the Erie service area.

3.2.1 Non-potable Demand at Existing Parks

Figure 3-1 shows the location of the irrigated parks listed in Table 3-1 Based on discussions with Town staff, providing non-potable system service to these parks may be more difficult than to new development due to higher costs of installing new infrastructure in already developed areas. However, several of the parks are located near existing or proposed non-potable infrastructure and could be served by the non-potable system for a relatively lower level of infrastructure improvements. Table 3-1 shows that based on 2012 water use, parks used nearly 57 million gallons (174 AF), of which, 24 million gallons (74 AF) was served with potable water and 32 million gallons (99 AF) of non-potable water.

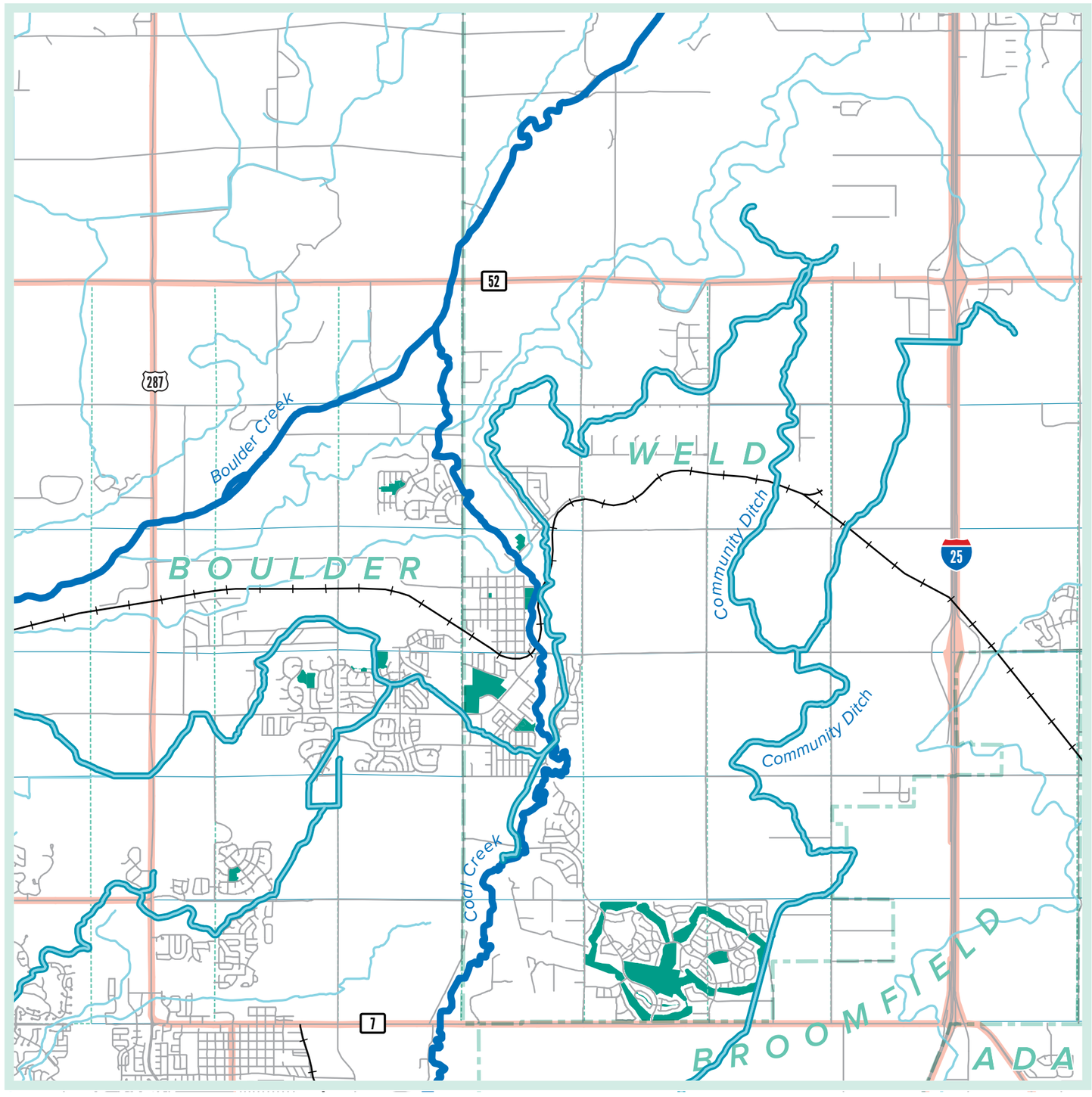
Based on preliminary non-potable infrastructure layouts and proximity to the existing reclaimed line, the parks most easily converted from a potable supply to the non-potable system would be Reliance Park (2.1 million gallons; 6.9 AFY) and Coal Creek Park (3.3 million gallons; 10.1 AFY.) Other parks could be served by the non-potable system, but converting these parks from potable supply to the non-potable system may be more costly than the water rights acquisition and potable water treatment savings that can be gained through providing non-potable water. More detailed infrastructure needs are discussed in Sections 4.2 and 4.3. These parks include:

- Arapahoe Ridge Park (4.2 million gallons; 12.9 AFY)
  - Could be supplied from existing infrastructure near Erie Lake, but would require a new pump station and infrastructure, including approximately 750 feet of pipe through an existing neighborhood (Dickens Street)
  - Likely not supplied with reclaimed water (but see Sections 4.2; Phase 4 and 4.3)

- Country Fields Park (4.6 million gallons; 14.2 AFY) and Longs Peak Park (5.7 million gallons; 17.6 AFY)
  - Could be supplied from a new pump station on the Leyner Cottonwood Ditch downstream of the lateral from Thomas Reservoir, and routed to the north of the subdivisions
  - Likely not supplied with reclaimed water (but see Sections 4.2; Phase 4 and 4.3)

figure **3-1.**

Irrigated Parks and Golf Course in Erie



LEGEND

- Coal and Boulder Creeks
- Canals with Erie Shares
- Irrigated Parks and Golf Course
- Highways
- Roads
- Railroad
- County Lines
- Section Lines

- Crescent Park (4.8 million gallons; 14.8 AFY)
  - Could be supplied from reclaimed line, but will require crossing some developed areas
  - Likely not supplied with reclaimed water (but see Sections 4.2; Phase 1 and 4.3)

In summary, Erie's current non-potable demand is approximately 99 AFY for Columbine Mine Park, Lehigh Park and the Erie Community Park and Erie Community Center, plus approximately 300 AFY for the Colorado National Golf Course exchange, for an annual total of nearly 400 AF. The conversion of existing Erie parks from potable to non-potable use could add up to an additional 78 AF of non-potable use by converting parks currently served by potable taps to the non-potable system.

Other areas could potentially be served with non-potable water, such as the Leon Wurl Service Center, and various smaller parks, greenbelts and some common areas owned by individual home-owners associations (HOAs). Other water providers on the Front Range that have installed reclaimed systems have had requests for non-potable water service from a variety of water users such as apartment complex and HOA common areas that were not included in the initial non-potable master planning. Erie may also receive requests for non-potable water service from other water users once the non-potable system is established and as a result, the long-term non-potable water demand may increase beyond initial projections. GIS data obtained from the Town indicates that currently there are approximately 42 acres of tot-lots (small neighborhood parks) in Erie, and approximately 190 acres of other irrigated land such as rights-of-way, HOA common areas and subdivision borders that potentially could be served with non-potable water. Based on a 30-inch target application rate over 70 percent of this area (to account for impervious areas such as sidewalks and playgrounds), conversion of the tot-lots and other irrigated lands could add up to 406 AFY in non-potable demand. The costs and logistics of serving these existing potable taps with a non-potable supply will require a future site-by-site analysis.

3.2.2 Estimated Non-Potable Demands for Future Developments

Erie desires to provide, where cost-effective and to the extent supplies are adequate, non-potable water to major future development areas in order to extend the existing water supply and reduce or delay water treatment plant capacity increases. DWC staff met with Erie staff on several occasions to discuss several Erie development projects in various stages of progress, and to discuss other areas where growth is expected to occur within the Erie service area. Figure 1-3 is a map of the potential future developments in the Erie service area. Most of these development parcels have not progressed to the detailed design stage of mapping specific parks, medians and other major facilities representing potential non-potable water demand. Information from the Bridgewater and Summerfield annexation agreements (see Section 2.4) and the Unified Development Code (UDC

Town of Erie 2013) was used to estimate non-potable demands for these future development parcels.

The two annexation agreements with Bridgewater and Summerfield provide estimates of non-potable use for larger parks and right-of-ways and do not contemplate serving individual single-family residential lots with non-potable water (see Section 2.4). The Bridgewater annexation agreement proposes to develop approximately 933 acres of raw land and calls for non-potable use of 120 AFY. The Summerfield agreement calls for 72 AFY and proposes to develop 640 acres of raw land. These two values equate to a non-potable demand projection of approximately 1 AF of non-potable demand for every 8 acres of raw land development.

This demand level was compared against Erie land use requirements outlined in the UDC. Based on the UDC, Erie requires 8 acres of larger size parks (community parks and neighborhood parks, tot lots excluded) per 1,000 residents. Currently, Erie uses 2.79 persons per dwelling unit to estimate the population from the number of proposed new homes (personal communication, Erie Director of Community Development October 2013). The Summerfield subdivision is expected to have 2,152 dwelling units and Bridgewater is expected to have 2,880 units, based on a development map provided by Town staff. Using the current persons per dwelling unit, Bridgewater will require 64 acres of parks and Summerfield will require 48 acres of parks, which account for 6.9 percent of the Bridgewater raw land size, and 7.5 percent of the Summerfield raw land size. The UDC also requires open space land dedication of 17 acres per 1,000 residents. Open space land does not require permanent irrigation, but may require temporary irrigation to establish the native vegetation. For the purposes of this Plan, the non-potable demand from temporary irrigation is not considered in the overall demand quantification.

In addition to the parks and open space, larger collector and arterial streets are required to have landscaped medians and rights-of-way along the larger arterial streets. The amount of landscaping in medians and rights-of-way varies by the location and type of road according to the UDC. An estimate of the amount of median and subdivision edge landscaping was estimated from a sample area near Erie Parkway and 119th. The combined area of the landscaped subdivision edges and medians in the sample areas and medians is approximately 21 acres for a developed area of approximately 400 acres, or about 5 percent of the raw land size. Much of this acreage is landscaped with shrubs, trees and rocks or mulch that have much lower water requirements than bluegrass.

Combining the parks requirement and the estimate of right-of-way landscaping, an estimated 12 percent of the raw land of a proposed development parcel will become parks or irrigated rights-of-way and can be irrigated with non-potable water. To estimate the water demand, the application rate for bluegrass was assumed at 30 inches and bluegrass is estimated to cover 70 percent of the park area (based on a comparison of

bluegrass acreage in parks to total park parcel area*), and 50 percent of the medians and right-of-ways (based on visual evaluation through satellite imagery). The remaining areas are assumed to be shrubs, trees, mulch, flowerbeds and paved surfaces (e.g. sidewalks and parking lots) with an aggregate application rate of 12 inches. These application rates result in an aggregate application rate of 23 inches on the gross acreage of parks and right-of-way non-potable landscaping. This amount also aligns with water use application rates of parks in 2012 when applied to the parcel size, and excluding Erie Community Park2. Using this application rate, applied to the 12 percent of raw development land that could be irrigated with non-potable water, the demand for non-potable water per acre of total raw developable land is 0.23 AF (12 percent of 23 inches), or 1.8 AF of non-potable water demand for every 8 acres of raw land. This method results in demand nearly two times the non-potable demands contained in the Summerfield and Bridgewater annexation agreements. These annexation agreements, however, allow for developers to acquire additional non-potable supplies. For the purposes of this Plan, the higher demand projection is used to estimate potential non-potable demand because the estimate is derived from the requirements in the UDC for parks and community landscaping that the Bridgewater and Summerfield developers may plan to meet in part with potable sources.

Commercial development represents less non-potable demand per acre of raw developable land than residential areas because of the lack of parks and limited landscaping compared to residential areas. Some commercial areas install significant amounts of landscaping, but most commercial developments along the northern Interstate 25 corridor incorporate only a limited amount of irrigated area. Aerial images of several developments from Highway 7 north to Fort Collins show, in general, limited landscaping in commercial and retail developments. The exception is the Hewlett Packard facility on Harmony Road in Fort Collins, which has a significant amount of landscaping. For the purposes of this report, commercial areas are assumed to have half of the residential non-potable water demand per acre of raw land. If development similar to the Hewlett Packard site occurs, demands will be higher and associated changes or upsizing of infrastructure may be necessary. Table 3-2 lists the development parcels, raw acreage and provides an estimate of non-potable water demand using non-potable demand of 0.23 AF per acre of raw residential development land, and 50 percent of this amount for commercial development areas.

The parcels shown on Figure 1-3 and in Table 3-2 are grouped by category and the stage of development. Bridgewater and Summerfield are the only developments for which DWC obtained annexation agreements. In Table 3-2, the 'Current Development' parcels were identified by Erie staff as parcels where construction is either occurring currently, or scheduled

* Erie Community Park is excluded because the parcel includes large areas of currently undeveloped land, and bluegrass covers approximately 30 percent of the parcel area (See Table 3-1). All other parks range from approximately 50 to 90 percent bluegrass area.

Table 3-2. List of Existing and Future Development Non-Potable Demands

Property Type	Development Name	Acres (approx)	AF non-pot[1]	AF non-pot + 25%[2]
Existing Non-Potable Use	Lehigh Park	7	22	28
	Erie Community Park and Community Center	49	61	76
	Colorado National Golf Course	230	300	375
	Columbine Mine Park	9	16	20
Existing Potable Conversion to Non-Potable	Coal Creek Park	6	7	9
	Reliance Park	5	6	8
	Longs Peak Park	9	18	22
	Country Fields Park	11	14	18
	Arapahoe Ridge Park	5	13	16
Annexation Agreement[3]	Summerfield	640	147	184
	Bridgewater	933	215	268
Current Development	Flatiron Meadows	160	37	46
	Compass	160	37	46
	Sunwest North	30	7	9
	Erie Commons Filing No. 4	20	5	6
	Velodrome	10	2	3
	Sierra Vista	60	14	17
	Vista Ridge #6	30	7	9
Potential Development	Calvary Church	12	3	3
	Lost Creek Farms	30	7	9
	Flatiron Meadows (future)	250	58	72
	Rex Ranch	70	16	20
	Erie Highlands	300	69	86
	Wise	160	37	46
	Right Move Lot 6	5	1	1
	Candlelight Estates	40	9	12
	Convair Hangars	12	3	3
	Andalusia	80	18	23
	Morgan Hill	250	58	72
	Sunset	100	23	29
	Pratt	290	67	83
	Golden Run	320	74	92
Likely Future Growth Areas	Section 10 (commercial)	640	74	92
	Section 15 (commercial)	640	74	92
	Section 16	400	92	115
	Section 21	320	74	92
	Total (Existing)	**332**	**458**	**573**
	Total (Future)	**6,294**	**1,682**	**2,103**

[1] based on 0.23 AFY of demand per acre of raw land for future residential development and half the rate for commercial developement. 2012 water use at existing parks

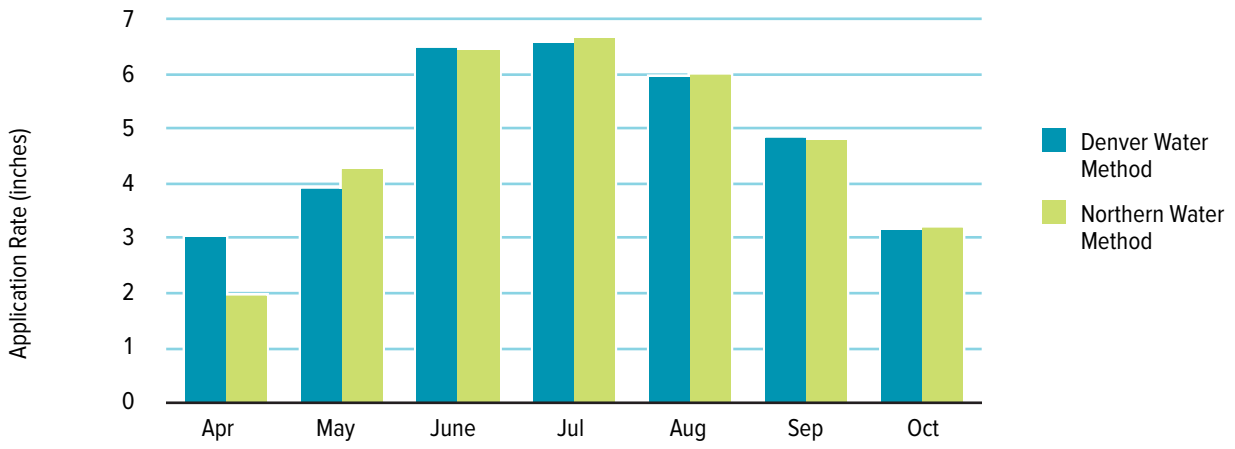
[2] increase based on higher demand from potential additional customers

[3] Annexation agreements non-potable demand is approximately 0.13 acres of developable land. Value shown in the table is based on estimate from the UDC of 0.23 AF/acre

to begin in the near future. The 'Existing Non-Potable Use' includes the Erie Community Center area, Lehigh Park and Colorado National Golf Course. The 'Potential Development' parcels were identified by Erie staff as parcels where there has been interest or initial contact made with the Town by developers. The 'Likely Future Growth Areas' are areas where Erie staff anticipate future development, but there are no specific development plans at this time. The total future non-potable demand from these parcels (including existing uses of non-potable water) is approximately 1,640 AFY. In addition to parks and irrigated areas, other potable customers may desire non-potable service if there is a reasonable net cost savings from conversion from potable to non-potable supply. For example, townhomes that have large common areas that are irrigated with potable water may opt to convert to non-potable to reduce HOA water bills that may represent a significant portion of the overall annual HOA expenses. Schools may also opt to use non-potable sources to irrigate playing fields to also save on water bills. To account for these potential add-on customers, the demands based on parks and right-of-way irrigation was increased by 25 percent. Table 3-2 shows both demands based on current, planned, and projected development and the demand increased by 25 percent to account for add-on customers.

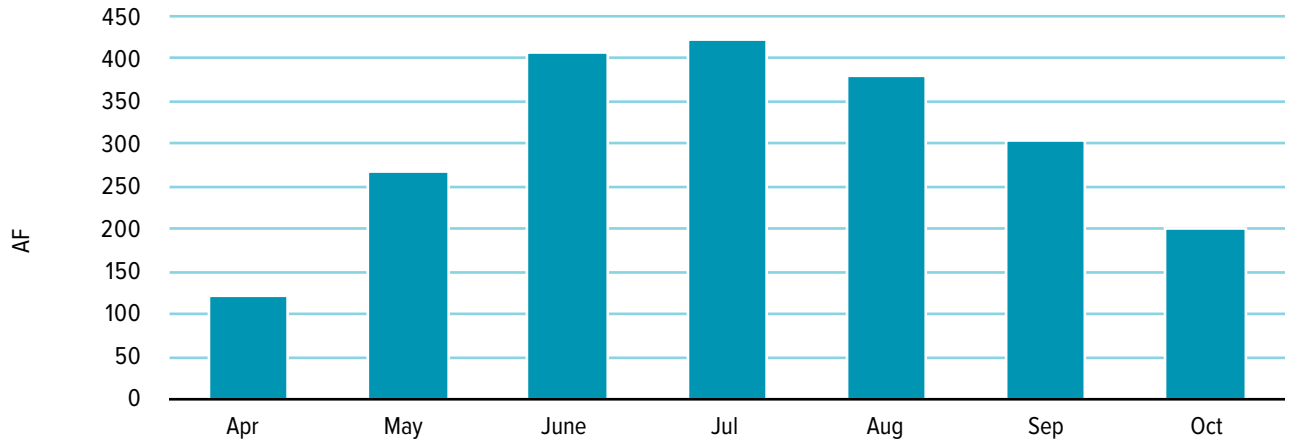
The non-potable demand shown in Table 3-2 is an annual demand. The non-potable water has been limited to irrigation only, and the irrigation season is limited from April through October. The irrigation demands vary from year to year depending on climatic factors such as temperatures and precipitation. Figure 3-2 shows the monthly irrigation requirement for bluegrass, based on data presented in Denver Water's 2012 Water Conservation Annual Report (Denver Water 2012). Denver Water presents two methods for estimating irrigation requirements and a typical monthly

figure **3-2.** Monthly Application Rate for Bluegrass Using the Denver Water and Northern Water Methods



irrigation demand pattern for bluegrass in Colorado, and shows that outdoor watering demands on average peak in June and July (Denver Water 2013.) The Northern Water method and the Denver Water methods for estimating blue-grass demand vary in the ratio of the water needs of irrigated turf relative to the reference grass pasture evapo-transpiration (ET) and in how effective precipitation is computed. The end result, however is very similar, except the Denver method calls for about an inch more water in April than the Northern Water method. Actual water requirements will vary by actual precipitation and temperatures with each year. Both the Denver Water and Northern Water methods estimate water demands at approximately 33 inches, but the Denver Water Conservation Annual Report cites a scientific journal article that states that turf can sustain deficit irrigation and that cool season grasses can be "deficit irrigated between 60-80% of full E-T and still maintain an acceptable appearance (Feldhake 1981)." Erie's target of 30 inches of irrigation application is in-line with the Denver Water and Northern Water estimates, and allows for a reduction in watering in dry years that will sustain the viability of the bluegrass, although it may show signs of stress. See Section 4.1 for a discussion of monthly irrigation amounts as related to peak flow rates for irrigation as it relates to infrastructure sizing. Figure 3-3 shows monthly non-potable demand for Erie, computed by using the 2,047 AF demand from Table 3-2 and applying the monthly distribution of demands shown in Table 3-3. The larger annual demand in Table 3-2 was selected in order to size infrastructure based on the larger reasonably plausible demand scenarios. The monthly maximum demand occurs in June and July of approximately 400 AF (4.3 MGD if constant through the month, not peak flows)

figure **3-3.** Monthly Non-Potable Water Demands for Erie



3.3 Comparison with Previous Projections

Estimates of non-potable use for Erie were developed in the 2007 Plan The 2007 Plan developed demands by applying estimated non-potable demands to various land uses shown in the then-current comprehensive land use map (see Figure 1-4 for an updated version of this map). The 2007 Plan involved a multi-step process whereby the outdoor irrigation demand for each land-use was estimated (potable and non-potable). Each land use category was then assigned a percentage of irrigation water that could be met by non-potable supplies, accounting for the continued use of potable water to irrigate individual residential lots. The total non-potable demand was summed by land sections (square miles) and spatially presented on a map. The estimated non-potable demand at buildout in the 2007 Plan using this method is 6,970 AFY.

The 2007 Plan estimates demands for many areas that are not included in the current Plan in Table 3-2. The 2007 Plan demand map (2007 Plan, Figure 5-3) projects higher demands for residential and commercial areas than estimated in Table 3-1. For example, Sections 10 and 15 that border Interstate 25 are largely regional commercial land uses, with some residential and mixed use. The 2007 Plan estimates demands in these two sections combined at more than 600 AF, whereas these two sections combined are estimated at 147 to 184 AFY in Table 3-1. If this area develops into office parks with significant amounts of landscaping, the demand may increase to levels projected in the 2007 Plan. However, if development is more similar to existing developments along Interstate 25, the landscaped area is less than the parks and right-of-ways in residential developments on a per-acre developed basis.

The buildout land use map, if used to estimate demands, represents a theoretical maximum demand at complete buildout of Erie. However, it is not economical to build current phases of the system to provide for demand that is not anticipated for many decades. Thus, the potential non-potable demand identified in this updated Plan is lower than the previous estimate in the 2007 Plan and represents demand to be met through a cost-effective, phased construction of a combined reclaimed and raw water non-potable system.

Section 4: Non-Potable Water Distribution Infrastructure

This section describes the layout of the non-potable distribution infrastructure to meet the demands quantified in Section 3. Design and construction of the system is separated into 5 phases that can be built as development occurs. Erie has the ability to use both reclaimed water and raw water supply to meet non-potable demands, and in some areas this Plan proposes to use the same infrastructure for both reclaimed and raw water supply. The current system uses raw water directly and reusable effluent by exchange. As noted, the NWRF reclaimed water reservoir and the first segment of the reclaimed pipeline from the reservoir to the SWRF have been constructed. The proposed system through Phase 5 of the non-potable system integrates the raw water and reclaimed water distribution systems to provide for system redundancy when raw water supply is low, minimizes operational costs and maximizes operational flexibility. The incorporation of the ability to convey raw water to customers generally receiving reclaimed water also allows for periodic flushing of salts that accumulate in soils from application of reclaimed water using the raw water that has a lower concentration of total dissolved solids (TDS).

4.1 System Design Considerations

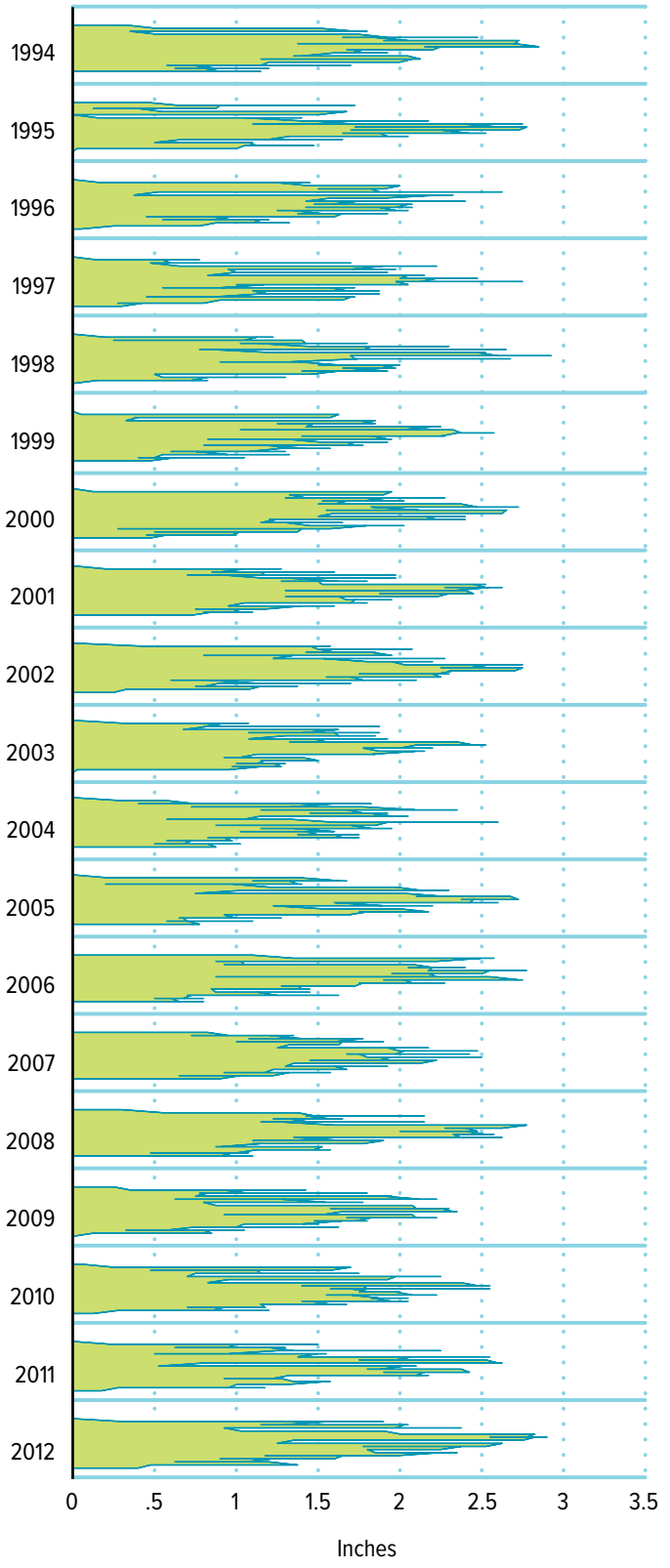
The goal of designing the non-potable system is to reliably meet system demands, optimize the use of non-potable water supplies, and maximize utilization of the infrastructure and thereby minimize infrastructure size and cost. The following are key items to consider in the design of the non-potable system:

- Reliability of non-potable water supplies and deliveries
- Timing of irrigation water application
- Centralized control of the reclaimed system
- Potential issues of using raw water and reclaimed water in the same infrastructure

4.1.1 Reliability of non-potable water supplies and deliveries

The reliability of non-potable water supply must be considered when designing a non-potable system. If raw or reclaimed water is not available, potable water supplies may be required to meet demands. Integration of the raw water and reclaimed water systems provides enhanced reliability

figure **4-1.** 7-day Total IWR for Bluegrass Using 60% DU



by providing two sources of non-potable water to many demand points in the system. Because of different requirements associated with different water sources, the availability of non-potable water is a function of hydrology, management of ditch water rights and the annual yield of C-BT, Windy Gap and other future supplies. Availability of non-potable supply from Erie's water portfolio is discussed in further detail in Section 5.1. Dual sources of supplies can also increase system reliability by providing opportunities for alternative delivery of non-potable water in the event of a pipeline or pump station failure that limits the ability to deliver one of the water sources.

4.1.2 Timing of Irrigation Water Application

The monthly demands shown in Figure 3-3 are average monthly demands. Due to normal variations in weather patterns both from year-to-year and intra-month, the demand is not distributed equally throughout the month. Daily evapotranspiration (ET) and precipitation data from 1994 to 2012 were obtained from the Northern Water website for the Longmont South station which is located in the Erie service area near Boulder Creek upstream from Highway 52. The Northern Water method of estimating turf water requirements (used to generate Figure 3-3) was applied to these data and reference E-T was multiplied by 0.81 to adjust from pasture grass reference ET to turfgrass ET. May through October precipitation was multiplied by 50% to represent effective precipitation, which is the amount of precipitation that is physically available to the turf and does not run off or percolate past the root zone). An irrigation efficiency estimate of 60 percent used by Erie staff was then applied to estimate the total water delivery demand (efficiency is also referred to as the distribution uniformity, or DU in irrigation systems). The water delivery requirement was summed in running 7-day totals with results shown in Figure 4-1. Figure 4-1 shows that the maximum peak-week irrigation requirement for turf grass varies from year to year between approximately 2.5 to 2.9 inches. DWC adopted a 3-inch peak week irrigation demand for turf for infrastructure sizing

purposes. The peak week application rate of 3 inches for turf represents 10 percent of the annual water demand for turf (3 inches of 30 inch annual application target). This ratio was used for all non-potable demands, such that infrastructure would be sized to meet a peak-week demand of 10 percent of the annual demand.

Intra-day timing of irrigation is also an important aspect for the non-potable system demand. Irrigation of parks normally occurs at night to reduce evaporation and allow for public use of parks during the day. In addition, regulations associated with application of reclaimed water (Regulation 84) require limited human exposure to reclaimed water. Watering at night when there is a reduced chance of reclaimed water direct spray to humans limits the chances of human exposure. For similar reasons, irrigation of medians and rights-of-way normally occurs at night. During the irrigation season, nights are shorter than days and E-T occurs during longer hours, reducing the most effective irrigation timeframe to approximately 8 to 10 hours per day. In order to maximize the non-potable system infrastructure, the non-potable delivery system can be utilized during daytime hours to deliver water to users in the system that have storage ponds. With the addition of water storage facilities, water can be staged in various points in the system to deliver water for irrigation during the night when E-T and risk of human exposure is lowest. The 2007 Plan recommended a 2 million gallon storage tank at the service area high-point located just north of Vista Ridge. A tank in this location would be very useful in Erie's non-potable system in addressing system pressures and peak hour demands, but is not recommended at this time due to expense and the existing and proposed storage ponds in the non-potable system. As demands increase in the future and experience is gained with system operations, the need for this tank should be evaluated.

Local storage ponds can be constructed and used as reservoirs for non-potable water while potentially providing aesthetic qualities to the area if well designed and integrated into the development. Storage ponds will fluctuate daily during the irrigation season, filling through the day and releasing to irrigation demands at night. This fluctuation can create an undesirable 'bath tub ring' effect or expose mud flats of the reservoir bottom or edges. To reduce these negative aesthetics, several features can be incorporated into the design of the ponds, such as steeper side slopes lined with attractive slide slope retaining materials to reduce the change in surface area through the fluctuations, and addition of a permanent pool in the pond that reduces the appearance of the daily fluctuations. Storage facility size estimates and recommendations are presented in Section 4.2, and these design options are addressed in more detail in that section.

Depending on the type of customers served by the non-potable system and the infrastructure limitations at their locations, some non-potable customers will be served through pumping water from the local ponds to their irrigation systems (pond-connected customer). For example, designs for new development areas with a significant amount of demand serving common areas and parks could include a local non-potable irrigation pond.

Some areas, however, should be directly connected to the pressurized line (direct-connect customer), for example, a smaller commercial development or residential HOA may not have adequate area or capabilities to manage a storage pond and require the simplicity of a direct connection to the non-potable system that operates similar to a potable connection. Ponds can be over-sized to assist in reducing the peak demands on the distribution system.

4.1.3 Non-potable System SCADA

In order to manage and optimize the capacity of the non-potable supply and infrastructure system, Erie should establish a SCADA system that allows operators at the NWRF to control valves, pumps and irrigation schedules of major customers connected to the non-potable system. SCADA control of the major non-potable system users allows the Town to optimize deliveries within the pump stations and pipeline capacities and manage energy costs by managing flows rates. Central control of the system also allows for the option to not maintain pressure in the lines at all times, and only pressurize when delivering water. In addition, to incorporate the two water sources into the system (raw water from Erie and Prince Reservoirs, and reclaimed water from the NWRF), pipe sizes will need to be larger on both ends of the system, which, if left unmanaged, can result in undesirable high flow rates in some sections of the system. Alternatively, in order to control water use in the system, Erie can establish operational rules for non-potable water users. These rules would provide water users with a set schedule and amounts for irrigation and would be designed to manage flow rates in the system, and minimize pumping costs. A remote monitoring system that actively relays water use to Erie staff would provide Erie the ability to monitor and enforce compliance with the operational rules without the expense of a full control SCADA system.

4.1.4 Potential Issues of Using Raw Water and Reclaimed Water in the Same Infrastructure

Erie has the ability to use raw water and reclaimed water within the same infrastructure to increase system flexibility and reliability. In addition, the ability to use raw water instead of reclaimed water can flush salts from areas irrigated with reclaimed water. Potential water quality issues associated with the delivery of two water sources having different water chemistry should be investigated in the future. It will be critical to maintain strict controls at all connections points between the raw water system and the reclaimed system to avoid any potential for contamination of any raw water supply that is contemporaneously being treated for potable purposes. These controls may include backflow prevention equipment, air-gaps at connections to the potable water system, physical disconnects from potable taps at locations converted from potable to non-potable and proper training for Town staff involved in operations and maintenance of the non-potable system

Water in Coal Creek has been found to contain bryozoans, tiny, colonial organisms, which can clog sprinkler heads and other system infrastructure. Currently, Colorado National Golf Course pumps water from Coal Creek and chlorinates the water to kill the bryozoan. A connection of the non-potable system with the Colorado National Golf Course system could introduce bryozoan into the system if not properly treated and managed at the Coal Creek diversion point.

4.2 Non-Potable System Design and Phasing

A conceptual layout of the non-potable water delivery system was developed to cost-effectively deliver non-potable water to existing and future non-potable demands throughout Erie. The plan is separated into five phases which can be built as development occurs in Erie. Due to the uncertainty associated with the timing of growth, different parts of the system may be built in a different order than presented in this plan, or phases can be further subdivided as growth and non-potable demands dictate.

To assist in layout and sizing of infrastructure, the demands quantified in Table 3-2 were grouped by geographic area, and are shown in Table 4-1. Some demands could be met from a variety of sources and infrastructure. More detailed description of each of the demand locations and potential ways to meet this demand is provided in Section 4.3.

As described above, piping and storage requirements for the system were based on meeting the peak-week demand, estimated at 10 percent of annual demand. Table 4-2 shows flow rates in various size pipes assuming a peak velocity of 5.5 feet per second (ft/s). Flow rates higher than 5.5 ft/s can be utilized if needed for peaking capacity that exceeds this design assumption, but pumping costs will increase*. As an example, pipe capacity increases by 18 percent by increasing the flow rate to 6.5 ft/s. Table 4-2 also shows the annual demand that can be met using storage facilities (pond-connected customers) and direct-connect customers. The annual demand that can be met was computed based on meeting the peak-week demand of 10 percent of annual demand. The peak week flow for storage connected facilities assumes a constant flow to the storage facilities throughout the week. This configuration allows for continuous use of the non-potable system, including filling of storage ponds in daytime hours when irrigation is not occurring. For direct-connect customers, the peak week demand was estimated by assuming 7 irrigation periods of 10 hours each day (70 hours

* Erie design standards Section 600 state maximum flow velocity of 10 ft/s, but also specifies maximum head drop values that would require maximum flow rates of less than 2 ft/s. DWC contacted Erie staff and this specification is currently under review. For this Plan, 5.5 ft/s was used for peak distribution system flow rates.

Table **4-1.**
Non-Potable Demands Arranged by Geographic Area

Region	Development Name	Acres (approx)	AF non-pot[1]	AF non-pot + 25%[2]
Existing Line	Andalusia	80	18	23
	Morgan Hill	250	58	72
	Calvary Church	12	3	3
	Lost Creek Farms	30	7	9
	Coal Creek Park	6	7	9
	Reliance Park	5	6	8
	Sunwest North	30	7	9
East	Bridgewater	933	215	268
	Erie Highlands	300	69	86
	Sunset	100	23	29
	Section 21	320	74	92
North	Summerfield	640	147	184
	Section 10 (commercial)	640	74	92
	Section 15 (commercial)	640	74	92
	Section 16	400	92	115
South	Lehigh Park[1]	7	22	28
	Erie Community Park and Community Center[1]	49	61	76
	Erie Commons Filing No. 4[1]	20	5	6
	Velodrome	10	2	3
	Right Move Lot 6	5	1	1
	Golden Run	320	74	92
	Compass	160	37	46
	Sierra Vista	60	14	17
	Vista Ridge #6	30	7	9
	Convair Hangars	12	3	3
Vista Ridge Connection	Colorado National Golf Course[1]	230	300	375
	Columbine Mine Park[1]	9	16	20
	Pratt	290	67	83
West	Flatiron Meadows	160	37	46
	Wise	160	37	46
	Flatiron Meadows (future)	250	58	72
	Rex Ranch	70	16	20
	Candlelight Estates	40	9	12
	Arapahoe Ridge Park	5	13	16
	Longs Peak Park	9	18	22
	Country Fields Park	11	14	18
Subtotals	**Existing Line**	**413**	**106**	**133**
	East	**1,653**	**380**	**475**
	North	**2,320**	**386**	**483**
	South	**673**	**225**	**281**
	Vista Ridge Connection	**529**	**383**	**479**
	West	**705**	**201**	**252**
Total		**6,294**	**1,682**	**2,103**

[1] indicates part of the existing non-potable system

[2] increase based on higher demand from potential additional customers

Table **4-2.** Flow Rates and Incremental Flow Rates for Pipes of Various Sizes

Pipe Capacity for Conceptual System Layout

Pipe Diameter	max velocity (ft/s)	Flow (MGD)	Annual Demand with Storage (AF)	Annual Demand Direct-Connect (AF)
4-inch	5.50	0.31	67	28
6-inch	5.50	0.70	150	62
8-inch	5.50	1.24	267	111
12-inch	5.50	2.79	600	250
16-inch	5.50	4.96	1,066	444
24-inch	5.50	11.17	2,399	1,000

— peak week volume with storage is constant rate through pipe over 7 days

— peak week volume for direct-connect customers is 7 irrigation cycles of 10 hours (70 hours)

— peak week demand is 10% of annual demand based on peak needs for turf

— max velocity assumed at 5.5 ft/s which is higher than Erie Section 600 specs suggest

Incremental Tables

Flow in excess of 8-inch pipe

Pipe Diameter	max velocity (ft/s)	Flow (MGD)	Annual Demand with Storage (AF)	Annual Demand Direct-Connect (AF)
12-inch	n/a	1.55	333	139
16-inch	n/a	3.72	800	333
24-inch	n/a	9.93	2,132	889

Flow in excess of 12-inch pipe

Pipe Diameter	max velocity (ft/s)	Flow (MGD)	Annual Demand with Storage (AF)	Annual Demand Direct-Connect (AF)
16-inch	n/a	2.17	466	194
24-inch	n/a	8.38	1,799	750

of flow). In practice, it is likely that there will be a combination of pond-connected customers and direct-connect customers, and the actual demand that can be met from a given pipe is between the values shown for 'with storage' and 'direct-connect' in Table 4-2. The lower portions of Table 4-2 also show the incremental demand that can be met from over-sized pipes.

Comparing Table 4-1 and Table 4-2, the total projected non-potable demand of 1,700 to 2,100 AFY can be met by the existing 24-inch reclaimed line from the NWRF if, storage facilities are included in the system design. The existing line cannot meet all peak-week demands, limited to 10 hours of irrigation per day, without local storage unless velocities in the line are increased to approximately 10 ft/s during the limited irrigation hours. It is also important to note that the 24-inch line

constricts to a 16-inch pipe at Highway 52. The 16-inch line will serve much of the non-potable demand in Erie except for the north and eastern areas along the Interstate 25 corridor. The 16-inch line from Highway 52 to the SWRF can meet an annual demand between 444 AFY and 1,066 AFY. Demands potentially served by the existing 16-inch line are projected between 1,224 AF and 1,530 AFY (total demand less north area demand in Table 4-1). This indicates that peak week demands cannot all be met by the existing reclaimed water line unless at least one of the following operations can reduce the demand on the reclaimed system:

- Utilize the raw water system to meet some demands (e.g. Erie Community Center and parks)
- Utilize the exchange of reclaimed water for Coal Creek diversions at the Colorado National Golf Course
- Utilize existing potable taps on parks during the peak-week
- Irrigation occurs for periods longer than 10 hours per day
- Allow flow rates to exceed 5.5 ft/s in the 16-inch reclaimed line
- Add additional storage that can meet a portion of the peak week demand in addition to storage required for daytime pond filling

The system can serve a larger demand than shown in Table 4-1 if storage facilities are over-sized for the peak week such that additional water is stored prior to the peak week and used to reduce peak flows in the distribution system. Storage facilities described in the following sections are sized to meet peak-week demands. However, if possible, storage facilities should be designed with potential future enlargement in mind to meet any future demands in excess of the projections in this Plan and for a permanent pool that could potentially buffer the peak flow rates during the peak week and enhance the pond aesthetics during non-peak operations. Descriptions of individual ponds in the following sections provide additional sizing details.

A conceptual infrastructure layout was developed based on the magnitude and location of demands shown in Table 4-1 and the demand amounts that can be met as shown in Table 4-2. The layout was designed in 5 phases, beginning with expansion of the existing system to meet demands in the next year through construction of the developments shown in Table 4-1. A series of schematics was developed to illustrate the phasing of the non-potable system design, shown in Figures 4-2 to 4-7. The infrastructure through Phase 5 was laid out on a map, and is shown in Figure 4-8. The following sections provide additional detail on infrastructure sizing and design assumptions. These details and assumptions should be reviewed during preliminary design of phases to verify assumptions with actual demand conditions as Erie develops. In addition, hydraulic system modeling of individual phases and the entire system should be conducted as implementation of this Plan proceeds.

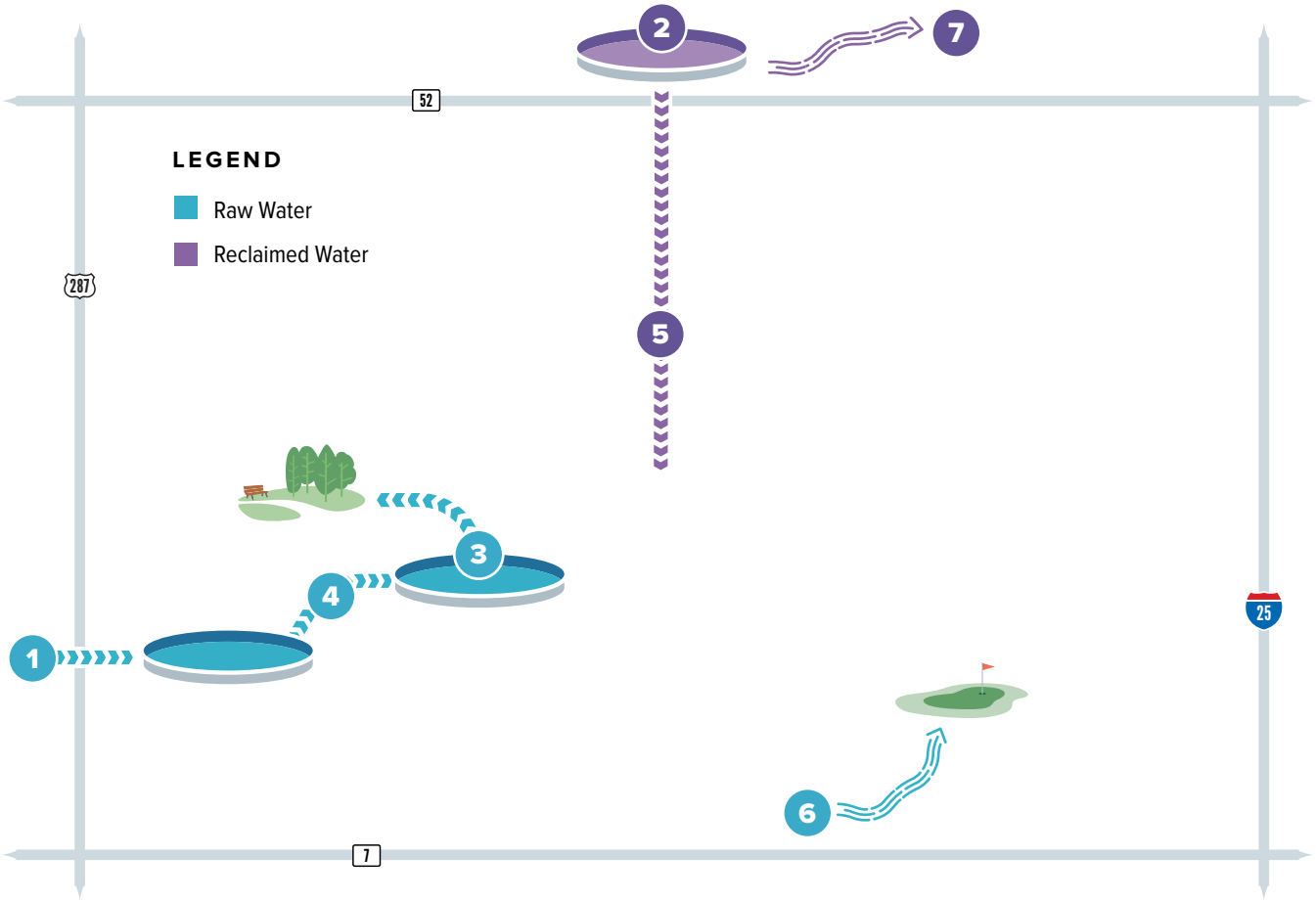
4.2.1 Existing System (Figure 4-2)

The existing non-potable system is described more fully in Section 3.1. Key infrastructure are:

- Northern Water Reclamation Facility capable of generating Category 2 reclaimed water
- 1,000 AF reservoir at NWRF for reclaimed water
- Reclaimed water pump station at NWRF with chlorination capability
- 24-inch reclaimed water line from NWRF to Highway 52
- 16-inch reclaimed water line from Highway 52 to SWRF near Historic Erie
- Leyner Cottonwood Ditch and Erie Commons irrigation pond
- Non-potable water lines from Erie Commons pond to Erie Community Center park area
- Approximately 1,000 AF of average-year ditch water, approximately 100 AF dry-year yield, shares of Leyner Cottonwood used on Erie Commons, augmented with C-BT
- Shared use of Erie, Prince and Thomas reservoirs for raw water for the non-potable system with potable system
- Reuse of consumable Windy Gap effluent used by the Colorado National Golf Course by exchange
  - Colorado National Golf Course diverts water from Coal Creek where Vista Parkway crosses Coal Creek
  - Erie discharges a similar amount of reusable effluent to Boulder Creek from the NWRF
  - Non-potable water diverted by exchange from Coal Creek is delivered to Columbine Mine Park through the Colorado National Golf Course infrastructure
- Irrigation ditches, including the Leyner Cottonwood, South Boulder Canon, Erie and Coal Creek Ditch and Farmers Reservoir Irrigation Company's Community Ditch (FRICO).

The existing system uses Erie ditch shares, C-BT water and Windy Gap effluent as sources of water for the non-potable system. The average annual demand met by the current system is approximately 400 AF.

figure **4-2.** Existing Non-Potable Water System



Existing

1. Raw water feed to WTP/Reservoirs
2. NWRF reservoir (1000 AF)
3. Parks Pond for irrigation of Erie Commons and Erie Community Park
4. Leyner Cottonwood Ditch
5. Reuse line NWRF to SWRF
6. Diversions from Coal Creek to CNGC and Columbine Mine Park
7. Reclaimed water release to Boulder Creek

4.2.2 Phase 1 (Figure 4-3)

Phase 1 of the design extends the system to the Bridgewater development, providing capacity for development south and east of Bridgewater. In addition, Phase 1 includes conversion of Reliance and Coal Creek parks from potable to non-potable and other developments along the existing line as development occurs. Both Reliance and Coal Creek parks are located near the existing and Phase 1 reclaimed lines and would be direct-connect taps.

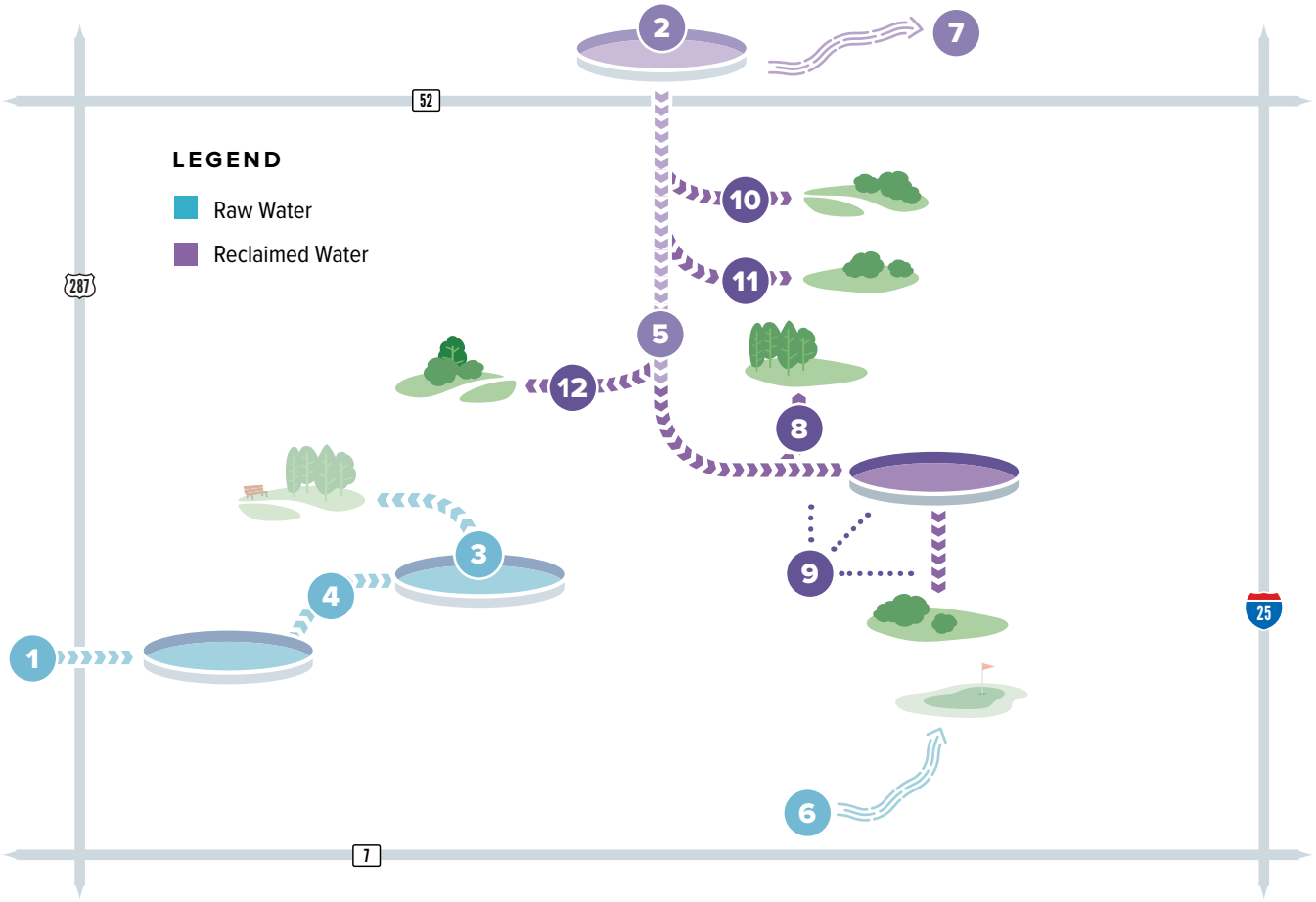
During the development of this Plan, Erie staff asked DWC for a recommendation for Phase 1 design concepts because the Bridgewater development was nearing construction and Erie needed to make a decision about pipes to serve the areas adjacent to Bridgewater by either oversizing the line to Bridgewater near the cemetery or planning for a line further south along Erie Parkway. DWC provided a memo in May 2013 that recommended oversizing the line to Bridgewater from an 8-inch line for Bridgewater, to a 12-inch line to a storage facility located near the intersection of Erie Parkway and County Road 5. This memo is provided as Appendix A. The Bridgewater developer has planned a storage facility to regulate non-potable water for the Bridgewater development (hereafter Bridgewater Pond No. 1). The oversized line would terminate in a second storage facility (hereafter Bridgewater Pond No. 2) that could serve several demands, including Erie Highlands, Sunset, the west half of Section 21, Erie High School and potentially other developments near Interstate 25, depending on timing of growth in these areas. The oversized line through Bridgewater would reduce to an 8-inch pipe after turnout to Bridgewater Pond No. 1, and terminate in Bridgewater Pond No. 2. Since the date of that memo, demands have been refined upwards based on the UDC (Section 3.2), but does not affect pipe size of the Bridgewater Line. As of the date of this report, the Town and the Bridgewater developer are jointly designing the extension from the SWRF to Bridgewater and the option for a second line along Erie Parkway is still under consideration.

The Phase 1 line to Bridgewater crosses the Erie and Coal Creek Ditch. A turnout from the Bridgewater Line to the Erie and Coal Creek Ditch can be utilized in the future (Phase 4), when the raw water system is integrated with the reclaimed system, to meet demands in the northern area with surplus raw water. The turnout could be constructed with Phase 4, but may be more economical at original construction during Phase 1.

Phase 1 Infrastructure:

- Extension of reclaimed line from SWRF to Bridgewater
  - 16-inch line from SWRF to point where Bridgewater line heads east to the Bridgewater development to accommodate future phases to the south
  - 12-inch line to Bridgewater, which is oversized from an 8-inch line originally intended for Bridgewater
  - Additional pond in or near the Bridgewater development to serve adjacent developments (Bridgewater Pond No. 2)

figure **4-3.** Non-Potable Water System — Phase 1



Existing

1. Raw water feed to WTP/Reservoirs
2. NWRF reservoir (1000 AF)
3. Parks Pond for irrigation of Erie Commons and Erie Community Park
4. Leyner Cottonwood Ditch
5. Reuse line NWRF to SWRF
6. Diversions from Coal Creek to CNGC and Columbine Mine Park
7. Reclaimed water release to Boulder Creek

Phase 1

8. Bridgewater line (and Pond No. 1)
9. Bridgewater extension and Pond No. 2 to feed points south (Erie Highlands etc) and ECC turnout
10. Morgan Hill and Andalusia Branches
11. Reliance Park and Coal Creek Park Branches
12. Lost Creek, Calvary Church, Kenosha Farms and Erie Village Branch

- 8-inch line after the turnout to Bridgewater Pond No. 1.
- Termination of 8-inch pipe in Bridgewater Pond No. 2.
- Extension of 8-inch pipe along Weld County Road 5
- Pump station from Bridgewater Pond No. 2 to the south extension
- Turn-out into Erie and Coal Creek Ditch

- Connections from the 16-inch line to Reliance Park and Coal Creek Park (Historic Erie ball fields)

- Ability to add additional connections to Morgan Hill and other smaller developments near the existing reclaimed line such as Lost Creek, Calvary Church, or extension to existing parks in Kenosha Farms or Erie Village)

It was assumed that the Bridgewater development would utilize the capacity of the 8-inch line referenced in the Bridgewater annexation agreement. Referring to Table 4-2, the annual demand that can be served by an 8-inch line varies between 111 and 267 AF, depending on the use of storage facilities or direct-connect demands. The non-potable demand of 120 AF specified in the Bridgewater annexation agreement falls within range. Demands for Bridgewater based on the UDC requirements project demands at 215 AFY. At the higher UDC-based demands, the 8-inch line appears to be adequately sized, provided the Bridgewater pond is sized to accommodate the peak week demands.

The incremental increase in annual demand that can be met by oversizing from an 8-inch to 12-inch line is 139 AFY to 333 AF for direct-connect and pond-connected taps, respectively. This incremental capacity, in conjunction with a second storage pond can meet the potential demands for several adjacent developments, including Bridgewater, Sunset, and Section 21 to the south, and Erie High School, Section 15 and Section 16 to the east. The total demand of Bridgewater, Sunset and Section 21 developments is projected at 166 to 207 AFY, which is between the annual demand that can be met with an 8-inch pipe with storage and with direct-connect customers. Addition of Sections 15 and 16 could provide additional demand of 166 to 207 AFY. At the upper end of these estimates, the demand would exceed the capacity in the Bridgewater Line. Sections 15 and 16 require a new sewer main to the north, and it is anticipated that a north reclaimed water line (North Line, see Phase 2) would be constructed parallel to the sewer line. Therefore, it is unlikely that the Phase 1 Bridgewater line would directly serve reclaimed water to the eastern areas. In Phase 5, the raw water feed could serve these eastern areas through the Bridgewater Line.

The second pond to meet the eastern demands (Bridgewater, Sunset, West Section 21) during the peak week was sized using an Excel based reservoir model. The demands total to 166 AFY, which is estimated at 16.6 AF during the peak week (2.4 AF or about 770,000 gallons per day). The model shows that the minimum active storage needed to regulate daily flows during the

peak week is 0.8 AF (about 260,000 gallons). If additional direct-connect customers irrigating only during the assumed 10 hour window each night are added to the 8-inch line, the pond size may need to be increased because the direct-connect customers will reduce the amount of water that can fill the pond at night. In addition, the pond can be over-sized to buffer peak demand by sizing based on inflow pipe capacity rather than

Table **4-3.** Bridgewater Pond No. 2 Sizing and Demand Results

Scenario		Peak Week Demand (AF)	Supply Pipe Size (in)	Initial Storage (AF)	Pond Size (AF)
1	base condition — full 8" capacity 24/7; minimum storage needed to regulate peak week demands	16.6	8	0	0.8
2	peak shaving (increase pond size, decreased inflow capacity for other direct-connect customers on line	16.6	6	2	3
3	peak shaving (increase pond size to maximize inflow pipe capacity)	24.9	8	0	2
4	peak shaving (increase pond size and initial storage can meet higher demands)	33.2	8	7	10
5	demand for total east and north demand exclusive of D (without 25% buffer)	55.2	8	32	32
6	demand for total east and north demand exclusive of Bridgewater (with 25% buffer)	69.0	8	45	45

demand regulation, or by having water in storage prior to the peak week (initial storage). The model shows that the peak week demand met out of the Bridgewater Pond No. 2 can be increased by 50 percent (249 AFY) with pond size of 2 AF, which fully utilizes the inflow pipe capacity. The demand can be doubled with a pond size of 10 AF and initial storage of 7 AF. In the scenarios with initial storage, the peak week ends with no water in storage. In practice, additional water should be kept in storage for the subsequent week, which would require additional storage. Design of the final pond size should consider additional storage to reduce daily fluctuations in water levels, and maintain a permanent pool for aesthetic reasons. Table 4-3 shows the pond sizing under various demand, initial storage and night-pipe flow reduction scenarios.

4.2.3 Phase 2 (Figure 4-4)

Phase 2 of the non-potable system involves meeting demand on the north and eastern parts of the Erie Service area. In order to develop this area, a new sewer line will have to be constructed to the NWRF because much of this area is in a different sewer-shed than existing sewer lines. During construction of sewer line, a new reclaimed line can be installed in the same right-of-way as the new sewer line. The new Phase 2 reclaimed line

(North Line) will connect to the existing 24" line at Highway 52 just before the existing line reduces from a 24-inch line to a 16-inch line.

Key Phase 2 Infrastructure:

- New reclaimed line (North Line) to serve the north and eastern service area
  - Connection to existing 24" reclaimed line where it reduces from a 24-inch line to a 16-inch line
  - 16-inch pipe to accommodate potentially multiple direct-connect customers in the proposed commercial development areas on the Interstate 25 corridor
  - Aligned parallel to new sewer line when constructed
  - Include branches to individual developments as development infrastructure is constructed

- May require capacity upgrade to the existing reclaimed water pump station at the NWRF to serve the North Line and the existing and Bridgewater lines (Phase 1)

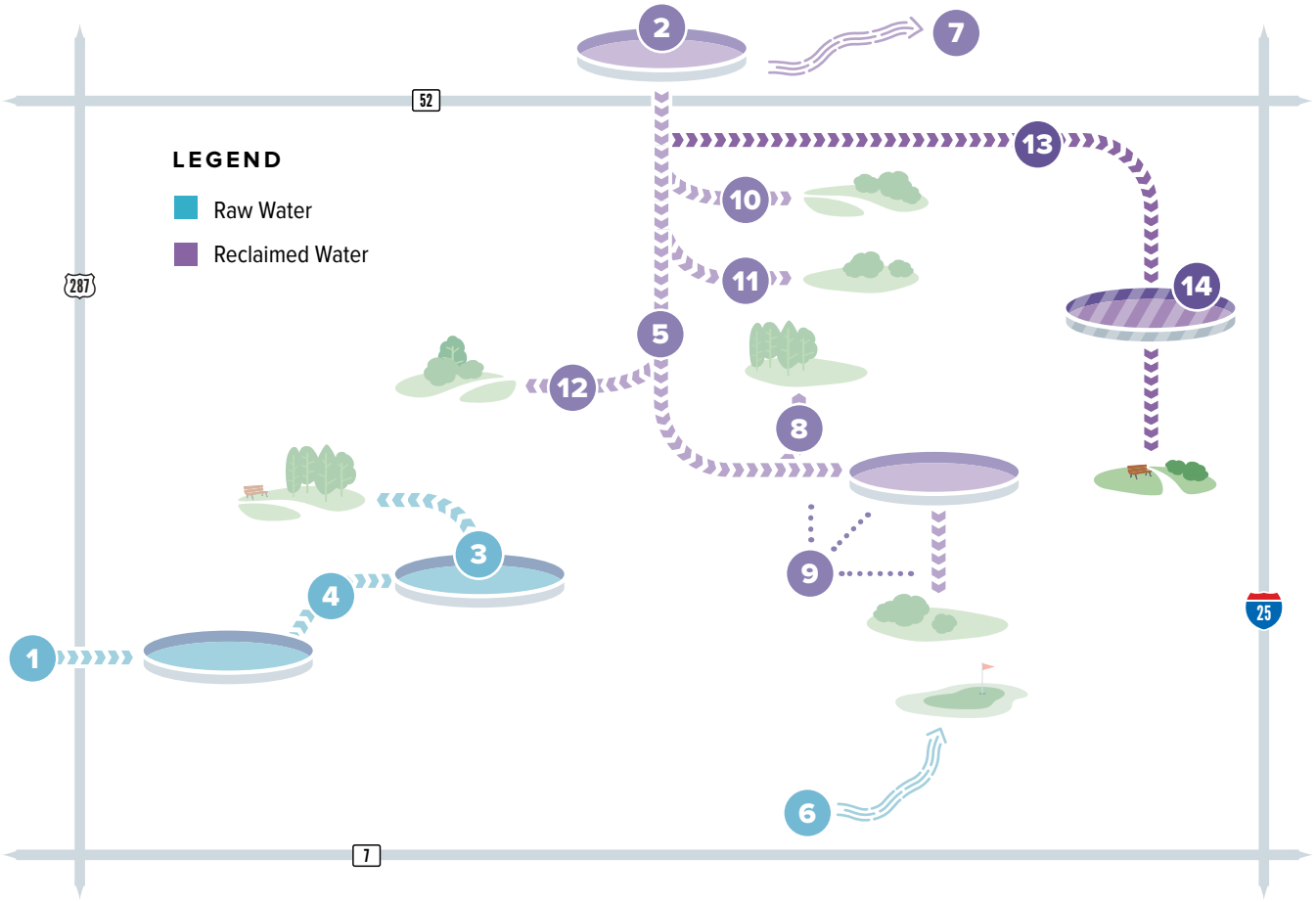
- Distribution pond may be necessary if demands increase beyond projections

- Raw water can be delivered to this area when connected to the raw water system in Phase 4. However, pond site selection should consider the future potential use of the Erie and Coal Creek Canal and Community ditch for delivery of raw water to this area.

The North Line can serve the proposed Summerfield development and future growth along the Interstate 25 and eastern Erie Parkway corridors (Sections 10, 15, and 16). The total demand projected for these areas is 386 to 483 AFY. However, the actual demand in these regions may differ significantly depending on the type of development that occurs. For example, if growth in Sections 15 and 16 are commercial and retail developments, outdoor irrigation demand will be relatively small, and may be below the projected amounts. However, if the areas develop as residential or other office parks with larger landscaped areas, demand could exceed the projections.

The North Line alignment will follow the sewer main through this area, likely following the geographic low between the NWRF and the eastern part of the service area. Branches from this line can reach the developing areas and either fill local storage or serve direct-connect customers, and will likely be located within a half mile of the property boundaries, depending on future subdivision and final alignment of the sewer line. Given the projected demand in this area, the pipe could be sized as a 12-inch pipe. However, there are several reasons to oversize this pipe:

figure **4-4.** Non-Potable Water System — Phase 2



Existing

1. Raw water feed to WTP/Reservoirs
2. NWRF reservoir (1000 AF)
3. Parks Pond for irrigation of Erie Commons and Erie Community Park
4. Leyner Cottonwood Ditch
5. Reuse line NWRF to SWRF
6. Diversions from Coal Creek to CNGC and Columbine Mine Park
7. Reclaimed water release to Boulder Creek

Phase 1

8. Bridgewater line (and Pond No. 1)
9. Bridgewater extension and Pond No. 2 to feed points south (Erie Highlands etc) and ECC turnout
10. Morgan Hill and Andalusia Branches
11. Reliance Park and Coal Creek Park Branches
12. Lost Creek, Calvary Church, Kenosha Farms and Erie Village Branch

Phase 2

13. North line to Summerfield and I-25 corridor
14. Potential distribution pond (if necessary)

- Demand along the Interstate 25 corridor is uncertain and will depend heavily on the type of development that actually occurs
- The cost differential between a 16-inch and 12-inch pipe is small compared to the overall costs of constructing either line ($109 per linear foot for 12-inch, $131 per linear foot for 16-inch, see Section 6)
- A larger pipe provides additional flexibility for future phases, including the connection to the raw water system and looping of the non-potable distribution system in future phases
- Additional capacity will allow service to Bridgewater, Sunset and Section 21 if demands in the southern part of the system (e.g. Vista Ridge) come to rely more heavily on reclaimed water.
- A local storage pond may be necessary to regulate water to the North Line demands and could also be used to store raw water supplies from the Erie and Coal Creek Ditch and Community Ditch, when in priority.

In addition, demand that can be met from the North Line can also be met through a raw water feed via the Erie and Coal Creek Canal, and the Community Ditch. Local storage ponds, if and when developed, should be sited to be able to accept waters from these ditches.

4.2.4 Phase 3 (Figure 4-5)

Phase 3 of the non-potable water system extends the system southward to meet several proposed and existing development areas. This Phase of the Plan could be further divided into smaller sub-phases if desired, however, the south and westerly extensions provide one of the main future connection points to the raw water system.

Key Phase 3 Infrastructure:

- 16-inch extension from the Bridgewater Line near Coal Creek south along Coal Creek to Vista Parkway
  - Branch to the Erie Commons Park pond to allow filling of the Parks pond with reclaimed water
  - Potential to pump from the Parks pond into the non-potable system at this point, providing a raw water feed to the reclaimed distribution system.
  - Connection to the Bridgewater Line results in a 16-inch/16-inch/12-inch tee. The larger 16" pipe size to the south is required for future connection to raw water system, but also requires central control of demands to manage flow rates in the existing line

- Connection to the Colorado National Golf Course system

- 8-inch line southeast extension along bike-path through Vista Ridge for Columbine Park and Pratt development

- 16-inch Southwest Line extension from Vista Parkway near Coal Creek
  - Branch service to Compass and Golden Run
  - Eventual connection point with raw water system to the west
  - Pipe sized for raw water feed in Phase 4. Demands met by this line from the reclaimed system are much lower than can be met by a 16-inch line

- 8-inch line south extension through the Erie airport to serve Convair Hangars, Sierra Vista and Vista Ridge filing No. 6

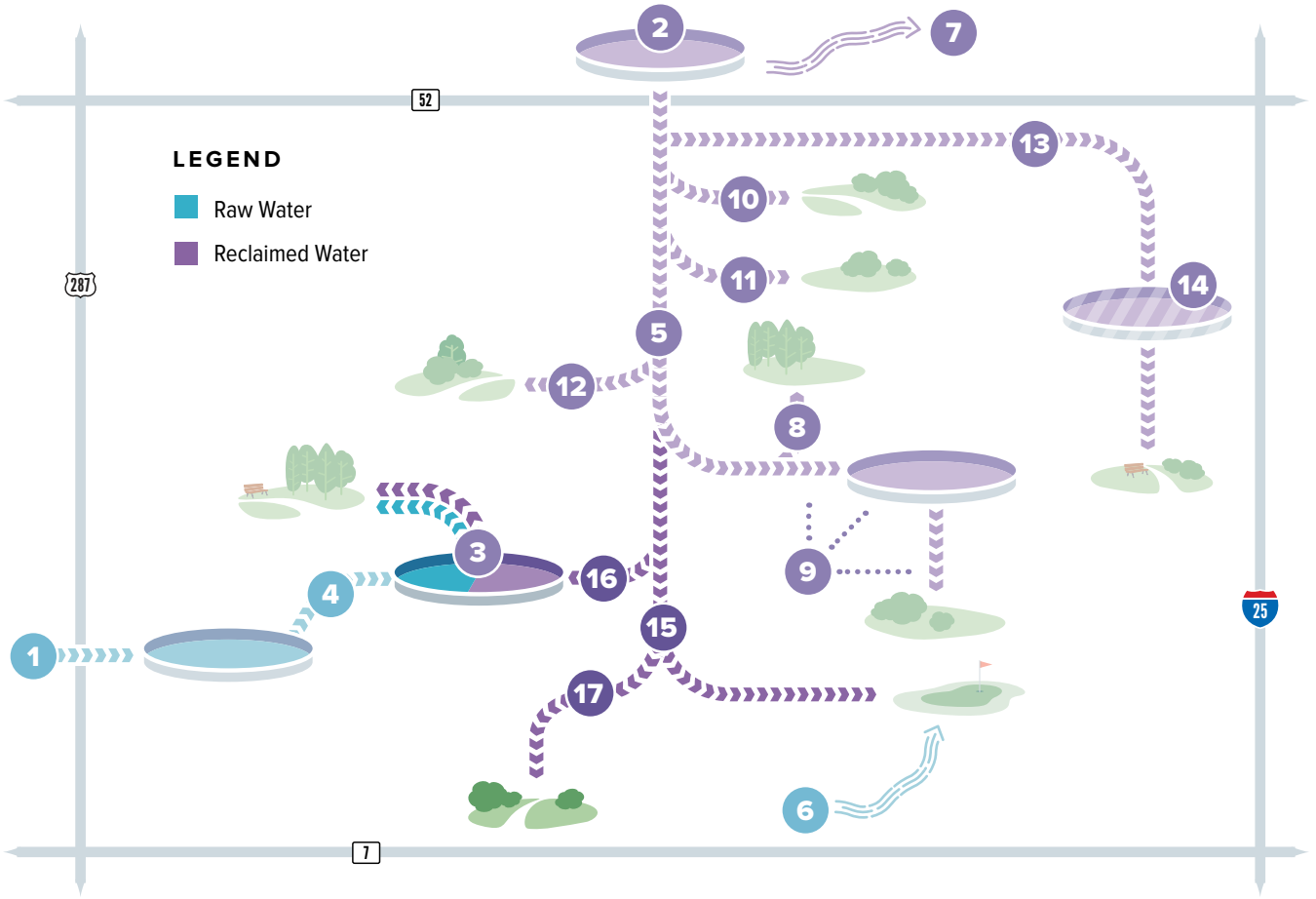
The extension from the Bridgewater line to the south will be a bi-directional flow pipe once the connection to the raw water system is made in Phase 4. As such, the pipe should be sized as a 16-inch line to support flows from the raw water system.

This line is one portion of Phase 3 that can be split into sub-phases. A limited southern extension to Erie Parkway can connect into two existing 6-inch lines that parallel Coal Creek just west of the Grandview subdivision. These lines are connected to the Erie Commons pond, and were originally used for native vegetation establishment but are no longer used for irrigation. A connection into these lines, assuming they are capable of handling the flows and pressures, would allow for filling of the Erie Commons pond from the reclaimed system, making the first inter-connection between the reclaimed system and the raw water system. This connection will allow Erie to also irrigate the Erie Community Park area and Lehigh Park with reclaimed water instead of relying solely on ditch water, C-BT and other raw water sources. This operation may become increasingly important as Erie's potable demand increases and high quality raw water is increasingly needed for potable use, especially in a year with a low C-BT quota.

Extending the line further south to the Colorado National Golf Course pump station will allow for a direct connection to the Vista Ridge system, if desired. Currently, Colorado National Golf Course diverts water from Coal Creek, which at that location is primarily wastewater effluent from Lafayette's wastewater treatment plant, located approximately one mile upstream. The golf course diverts this water via an exchange whereby Erie discharges a similar amount of consumable effluent from its NWRF to replace the golf course's diversions. Coal Creek contains the invertebrate bryozoan, which can clog pipes and sprinkler heads if not properly chlorinated. The reclaimed water from Erie's NWRF does not contain the bryozoan and potentially has better water quality characteristics than water diverted from Coal Creek for other parameters, but would require pumping to this point. The golf course is the largest single demand for non-potable water in Erie, using approximately 300 AFY, which represents approximately 15 to 20 percent of the total system demand.

The proposed Pratt development to the north of Vista Ridge will have additional non-potable demand. This phase of the Plan proposes an

figure **4-5.** Non-Potable Water System — Phase 3



Existing

1. Raw water feed to WTP/Reservoirs
2. NWRF reservoir (1000 AF)
3. Parks Pond for irrigation of Erie Commons and Erie Community Park
4. Leyner Cottonwood Ditch
5. Reuse line NWRF to SWRF
6. Diversions from Coal Creek to CNGC and Columbine Mine Park
7. Reclaimed water release to Boulder Creek

Phase 1

8. Bridgewater line (and Pond No. 1)
9. Bridgewater extension and Pond No. 2 to feed points south (Erie Highlands etc) and ECC turnout
10. Morgan Hill and Andalusia Branches
11. Reliance Park and Coal Creek Park Branches
12. Lost Creek, Calvary Church, Kenosha Farms and Erie Village Branch

Phase 2

13. North line to Summerfield and I-25 corridor
14. Potential distribution pond (if necessary)

Phase 3

15. Southern extension to CNGC pump station and southern subdivisions
16. Reuse System Interconnect with Parks Pond for Erie Commons
17. Southwest extension to Golden Run, Compass

8-inch line from Vista Parkway, paralleling the bike path through Vista Pointe subdivision, and then providing service to the Pratt subdivision at its southwest corner. This line could potentially be extended to serve Columbine Park, but would require relatively significant expenses to install a new line through the Vista Ridge subdivision and would duplicate existing non-potable infrastructure owned by the Colorado National Golf Course. See Section 4.3 for additional options for the Pratt subdivision. An agreement between the Town and Colorado National Golf Course may be possible that would benefit both parties. The following are considerations of a potential agreement

- Erie provides non-potable supply at the Vista Ridge pump station as
  - Reclaimed water via the reclaimed system—free of bryozoan and higher quality than Coal Creek
  - Raw water via the interconnect to the raw water system (see Phase 4)—free of bryozoan
  - The current Coal Creek water delivered to Vista Ridge via the existing diversion structure in exchange for consumable effluent at the NWRF—contains bryozoan

- Colorado National Golf Course delivers water to the Columbine Park for Erie via Vista Ridge's existing non-potable infrastructure at a reduced price.

The Town benefits by reducing costs paid to irrigate Columbine Park with non-potable supplies through the Colorado National Golf Course system and avoids potential infrastructure costs of bringing a reclaimed line to the Park, and the ability to sell surplus raw water supplies (e.g. C-BT). Colorado National Golf Course benefits by receiving water free from bryozoan from two of the three possible sources. The agreement can further delineate the value of water with and without bryozoan to Colorado National Golf Course and the rate that both parties are willing to pay for the water. For example, Erie could charge a fraction of the normal non-potable rate for an amount of water delivered to the golf course that is equal to the amount of water delivered to Columbine Park. This agreement also provides environmental benefits by increasing the flow in Coal Creek through the entire Erie service area by delivering water to the golf course via pipeline instead of via exchange. Conversely, there are additional pumping costs in delivering raw or reclaimed water to Colorado National Golf Course compared to its current low head pumping out of Coal Creek.

An additional 8-inch line extension to the south through the Erie airport can serve the Convair Hangars, future airport demand (e.g. aircraft washing), and irrigation needs to the Sierra Vista and Vista Ridge Filing No. 6, both located on the southern border of the service area.

4.2.5 Phase 4 (Figure 4-6)

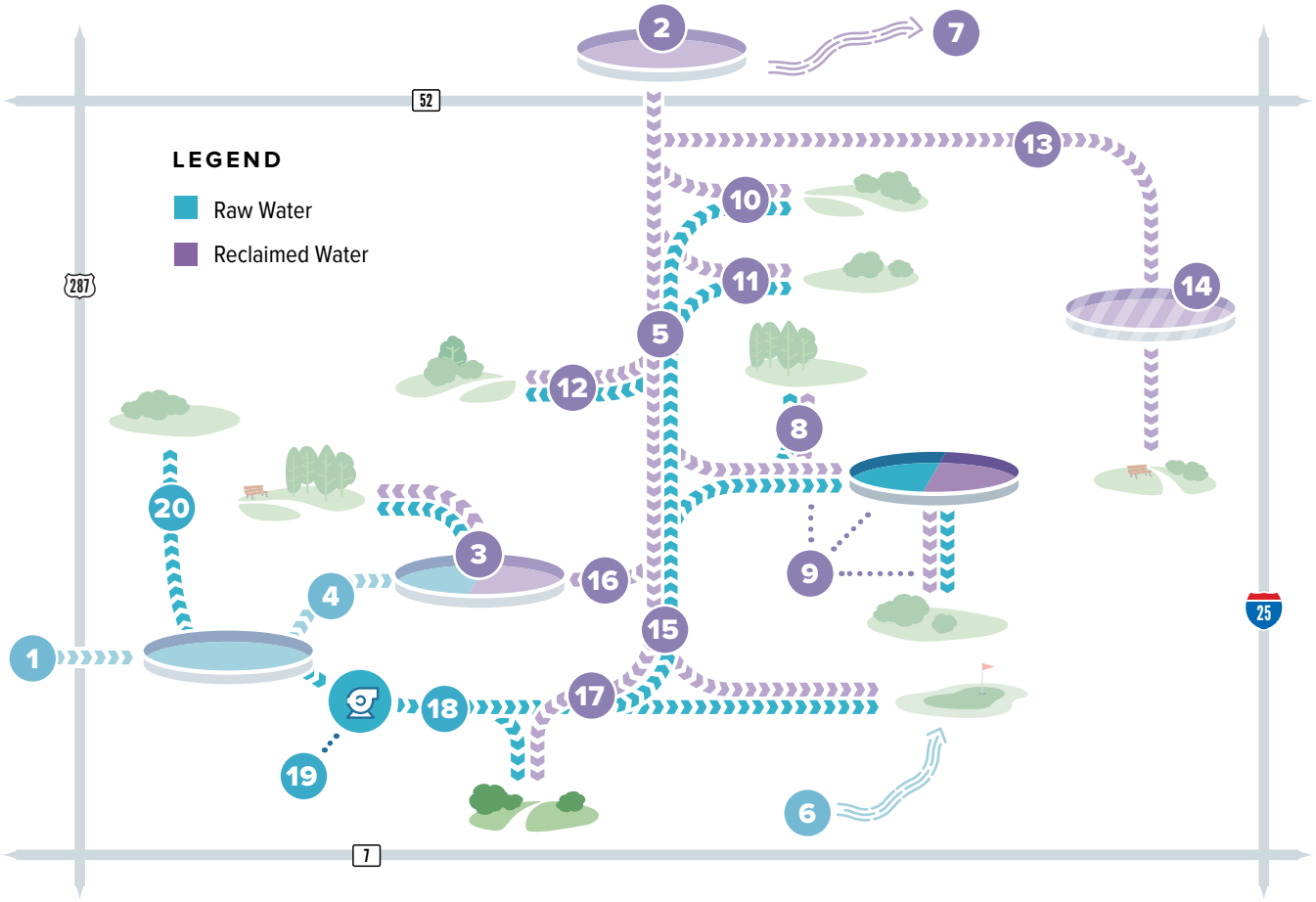
Phase 4 of the non-potable system provides the primary interconnection between the reclaimed system and the raw water system. This interconnection allows for operational flexibility between the two supply points (NWRF and western raw water feeds) depending on the current water availability, non-potable and potable demands.

Key Phase 4 Infrastructure:

- 16-inch extension of the Southwest Line (see Phase 3) to the raw water system located at the Lynn R. Morgan WTF.
- Pump stations to deliver raw water through the reclaimed system
  - At the Lynn R. Morgan WTF
  - May require a booster pump station at the Bridgewater Line to pump to the eastern area
- Raw water can be routed to Morgan Hill and Andalusia and to the east through the Bridgewater Line and beyond (see Phase 5)
- Raw water lines or ditch facilities to supply western subdivisions, including Flatiron Meadows, Wise, Candlelight Estates, Rex Ranch, Longs Peak Park and Meadow Sweet Farms Park (see Section 4.3 for additional details for each area)
- Appropriate cross-connection prevention at the connection between the raw water system and the reclaimed system at the Morgan WTF.
- Delivery of raw water to the area served by the North Line (see Phase 2) can also occur via a turnout from the Bridgewater Line to the Erie and Coal Creek ditch.

The necessity of the booster pump station near the Bridgewater Line will depend on several factors, including actual demands, the relative amount of pond-connected and direct-connect customers and associated flow rates and head losses through the system, including potential simultaneous use of the reclaimed pump station at the NWRF and the raw water pump station at the Morgan WTF. Depending on future use, a single pump station located at the existing Morgan WTF may be able to supply the entire system with raw water. This decision should be made at the time of the interconnect when demands and system performance is better known, but the location of the Bridgewater Line connection to the existing reclaimed line should anticipate the potential for a future booster pump station. Hydraulic modeling should be conducted as a follow up to this Plan to assist in this evaluation.

figure **4-6.** Non-Potable Water System — Phase 4



Existing

1. Raw water feed to WTP/Reservoirs
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3. Parks Pond for irrigation of Erie Commons and Erie Community Park
4. Leyner Cottonwood Ditch
5. Reuse line NWRF to SWRF
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Phase 1

8. Bridgewater line (and Pond No. 1)
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11. Reliance Park and Coal Creek Park Branches
12. Lost Creek, Calvary Church, Kenosha Farms and Erie Village Branch

Phase 2

13. North line to Summerfield and I-25 corridor
14. Potential distribution pond (if necessary)

Phase 3

15. Southern extension to CNGC pump station and southern subdivisions
16. Reuse System Interconnect with Parks Pond for Erie Commons
17. Southwest extension to Golden Run, Compass

Phase 4

18. Raw water connection to southwest extension to back-feed system with raw water
19. Pump station for raw water back-feed
20. Raw water nonpotable supply to Flatirons Meadow, and other western subdivisions

4.2.6 Phase 5 (Figure 4-7)

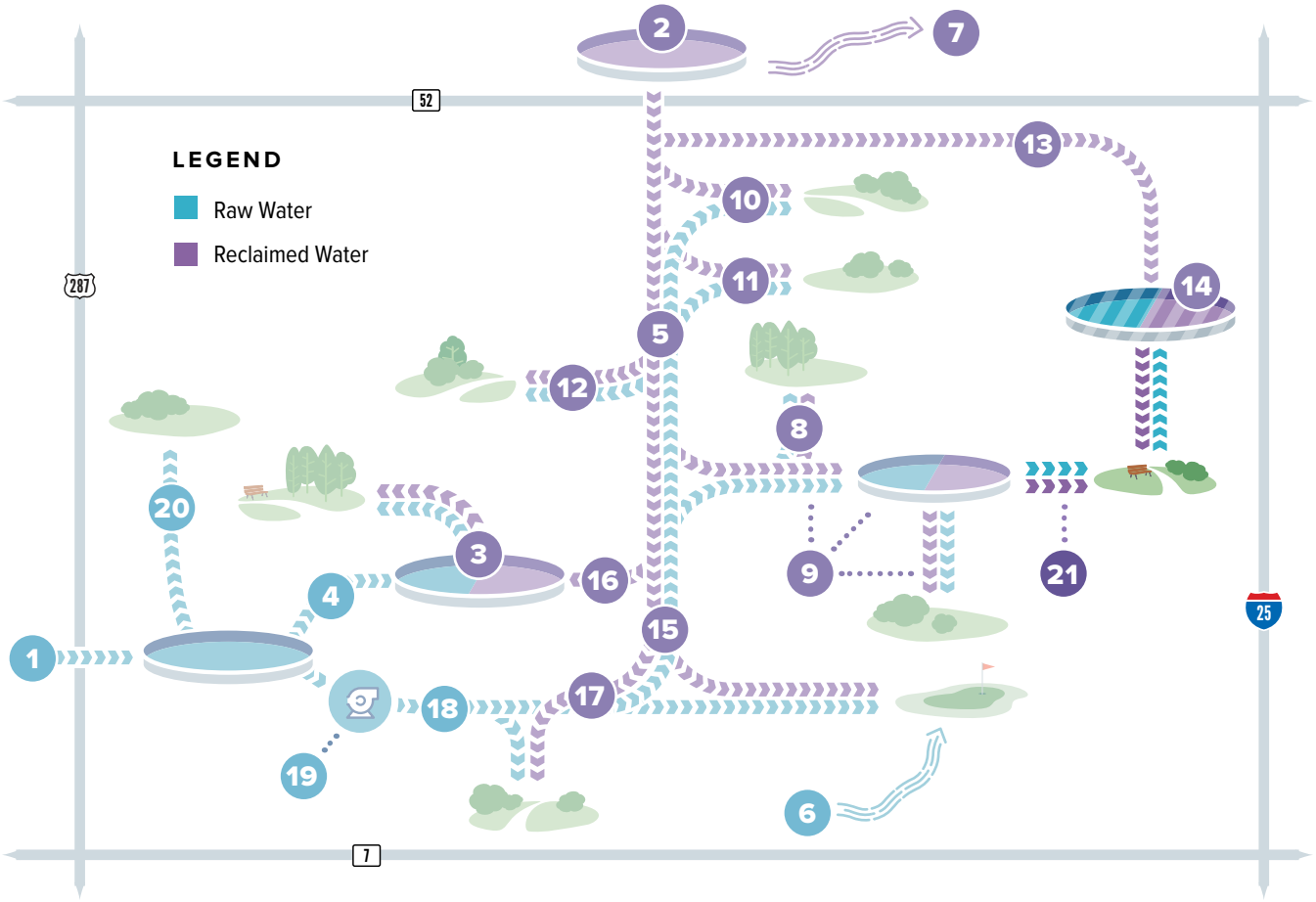
The fifth and final phase of the non-potable system design in this Plan is to add a loop between the Bridgewater Line and the North Line. This line will provide for raw water deliveries to the North Line demands and will provide additional flexibility in meeting the eastern area demands as that area develops.

Key Phase 5 Infrastructure:

- 12-inch line from Bridgewater Pond No. 2 to the North Line

The looping of the system provides system reliability and provides additional operational flexibility to fully utilize the capacity in the existing 24-inch pipe from the NWRF by shifting some additional demand in the eastern areas to the North Line from the Bridgewater line. The necessity of looping the system can be better determined through hydraulic modeling once actual demands, the type of connection to the non-potable system, and overall system operations are better understood as development occurs throughout Erie.

figure 4-7. Non-Potable Water System — Phase 5



Existing

1. Raw water feed to WTP/Reservoirs
2. NWRF reservoir (1000 AF)
3. Parks Pond for irrigation of Erie Commons and Erie Community Park
4. Leyner Cottonwood Ditch
5. Reuse line NWRF to SWRF
6. Diversions from Coal Creek to CNGC and Columbine Mine Park
7. Reclaimed water release to Boulder Creek

Phase 1

8. Bridgewater line (and Pond No. 1)
9. Bridgewater extension and Pond No. 2 to feed points south (Erie Highlands etc) and ECC turnout
10. Morgan Hill and Andalusia Branches
11. Reliance Park and Coal Creek Park Branches
12. Lost Creek, Calvary Church, Kenosha Farms and Erie Village Branch

Phase 2

13. North line to Summerfield and I-25 corridor
14. Potential distribution pond (if necessary)

Phase 3

15. Southern extension to CNGC pump station and southern subdivisions
16. Reuse System Interconnect with Parks Pond for Erie Commons
17. Southwest extension to Golden Run, Compass

Phase 4

18. Raw water connection to southwest extension to back-feed system with raw water
19. Pump station for raw water back-feed
20. Raw water nonpotable supply to Flatirons Meadow, and other western subdivisions

Phase 5

21. Loop system from Bridgewater Pond to Northern line

4.2.7 Summary and Mapping of Phases

The existing system and the five implementation phases are summarized in Table 4-4. In addition, Figure 4-8 shows the system through Phase 5 drawn on a map of the Erie service area. The pipe routes shown on the map are approximate, and meant to follow major right-of-ways or suggest a general route. More detailed alignment studies will be required with the specific design of each reach. The alignments do not consider utility crossings, stream or ditch crossings or associated permitting. In many instances, a longer pipe alignment that avoids or reduces the number or complexity of crossings or permitting may save a significant amount of expense.

Elevation profiles for the major transmission lines described in this Plan were developed, generally following the route shown on Figure 4-8. These elevation profiles provide a good estimate of topography of the line, but are not intended to substitute for actual elevation profiles developed as part of an alignment study for design of these lines. The elevation profiles are shown in Figure 4-9 to 4-12.

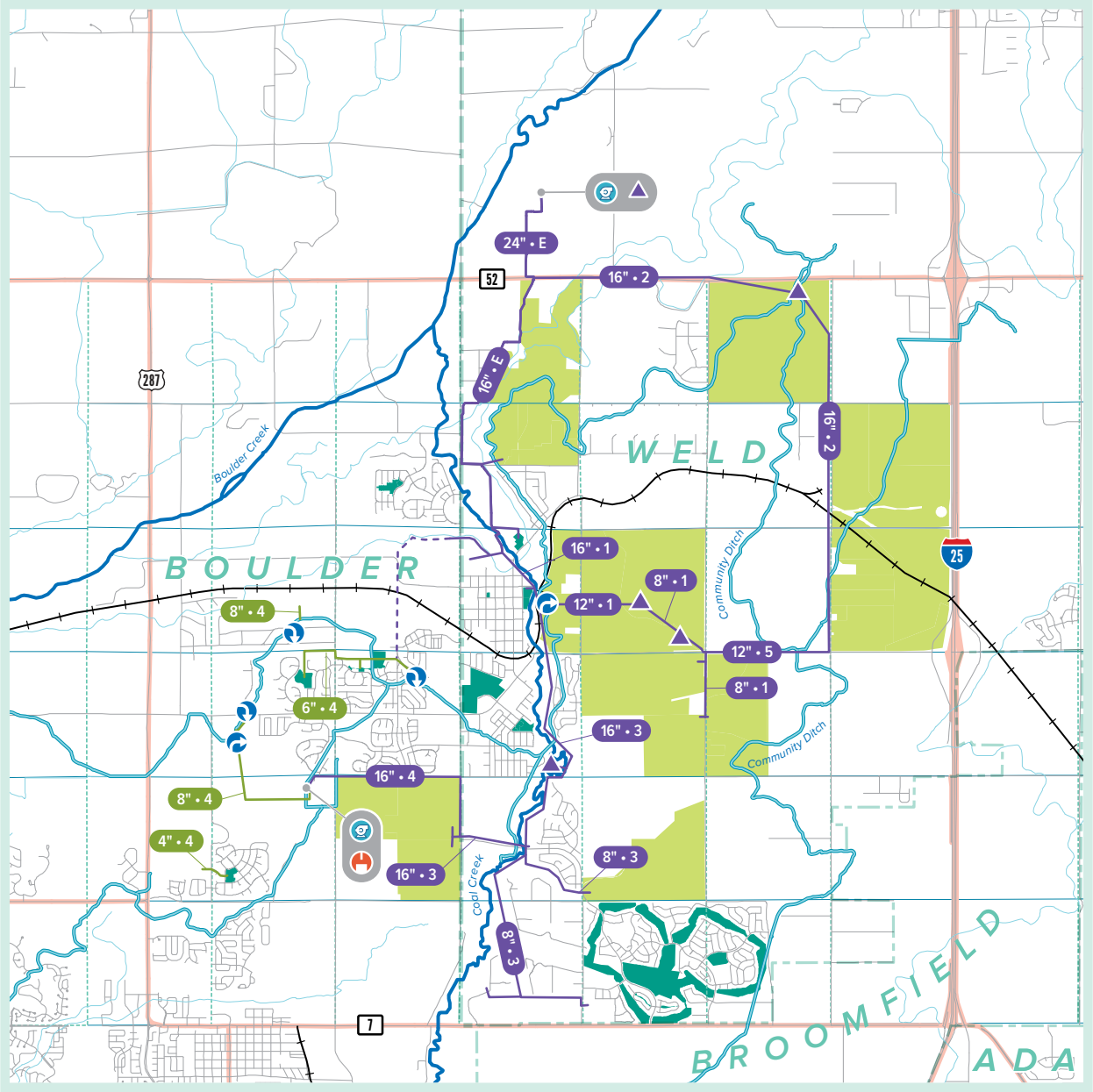
Table **4-4.** Summary of Non-Potable Implementation Phases

Phase	Brief Description	Approximate Demand Served (AF)[1]
Existing	NWRF reclamation facility, reservoir and existing 16-inch line to SWRF. Raw water used on Erie Community Park area. Windy Gap effluent used by exchange on Colorado National Golf Course	505
1	Bridgewater Line from Old Town area to Bridgewater and developments further east and south via local storage. Branch service from existing line to nearby developments and parks (e.g. Coal Creek and Reliance Parks)	608
2	North Line from existing line to north and eastern areas along Interstate 25	483
3	South Line from Bridgewater Line to Vista Ridge Pump Station and west to new development. Potential new line to Pratt development. Phase also includes branch to existing Erie Community Park pond, south branch to Erie airport, Sierra Vista and Vista Ridge Filing No. 6.	255
4	Raw water system connection with reuse system and expansion of raw water system to western subdivisions	252
5	Loop Bridgewater Line and North Line to provide additional operational flexibility and water source selection for areas east of Coal Creek	0
	Total Non-Potable Demand	**2,103**

[1] demand is UDC projected demands plus 25 percent as shown in Tables 3-1 and 4-2

figure **4-8.** Map of Non-Potable System Through Phase 5

Oversized version of this figure is available in pocket folder.



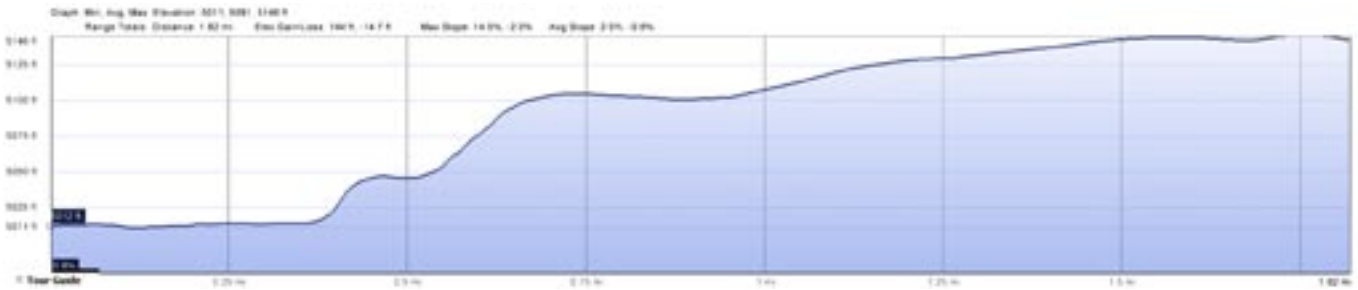
LEGEND

- Pump Station
- Air Gap or Backflow Prevention
- Diversion from Ditch
- Discharge to Ditch
- Reclaimed Pond / Reservoir
- Coal and Boulder Creeks
- Canals with Erie Shares
- Proposed Reclaimed or Raw Line
- Optional Line
- Raw Line
- 8" • 4 — Pipe Size • Phase (E = Existing)
- Highways
- Roads
- Railroad
- County Lines
- Section Lines
- Future Growth Parcels
- Irrigated Parks and Golf Course

N

Miles: 0 1 2 5

figure 4-9. Elevation Profile of Bridgewater Line (Phase 1)

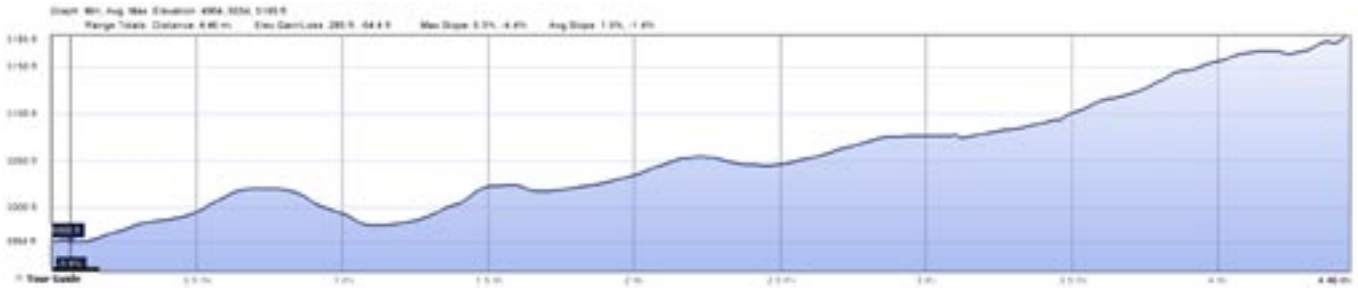


SWRF

Bridgewater Pond No. 2

Cross section generated in Google Earth

figure 4-10. Elevation Profile of North Line (Phase 2)

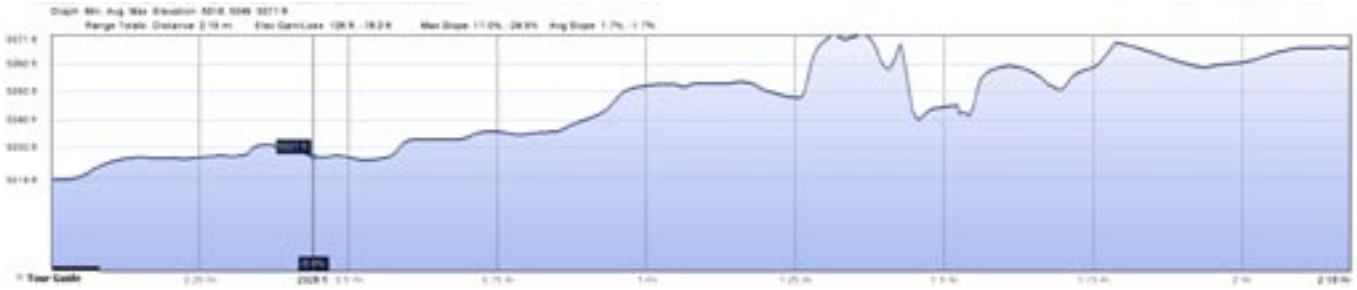


SWRF

WCR 5 and middle of Section 15

Cross section generated in Google Earth

figure **4-11.** Elevation Profiles of Southern Line (Phase 3)



Bridgewater Line at Coal Creek

Vista Parkway at Coal Creek

Sierra Ridge Extension

Vista Parkway at Coal Creek

Vista Ridge Filing 6

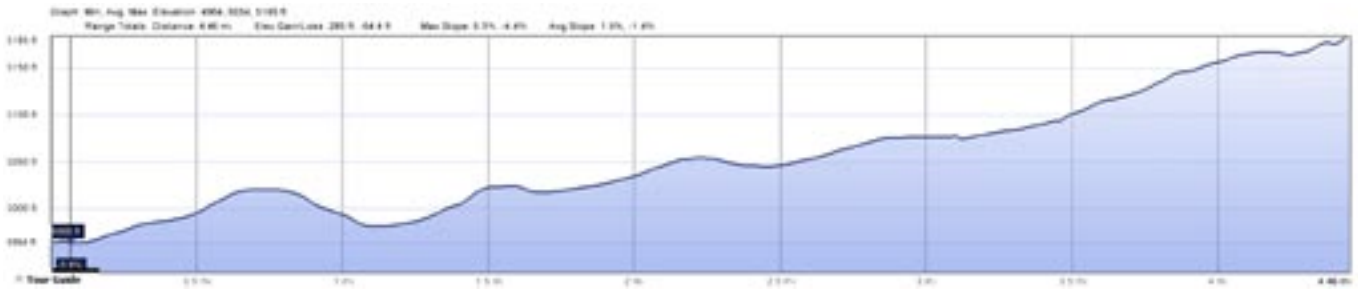
Southwest Extension

County Line Road at Vista Parkway

Vista Parkway at Coal Creek

Cross sections generated in Google Earth

figure **4-12.** Elevation Profile of Interconnect to High Point (Phase 4)



Morgan WTP

Bridgewater Line at Coal Creek

Cross section generated in Google Earth

4.3 Non-Potable Water Delivery Options Listed by Development

This section describes each potential non-potable demand area identified in Tables 3-2 and 4-1 and provides a description of how non-potable water can be delivered to the demand. This description generally conforms with the implementation phases described in Section 4.2, but also includes other potential options for supplying the development. The developments in the section are listed in the same order as shown in Table 4-2.

4.3.1 Morgan Hill

Morgan Hill can receive non-potable water through a branch from the existing reclaimed line as described in Phase 1 (Section 4.2.2). Raw water can also be delivered to Morgan Hill through the interconnection of the raw water system and reclaimed system described in Phase 4 (Section 4.2.5).

In addition, deliveries to Morgan Hill could be made through the Erie and Coal Creek Ditch (ECCD), which flows through the Morgan Hill development. Erie could make deliveries to Morgan Hill through the ECCD when 1) the ECCD is diverting water or 2) through the Bridgewater Line turnout (raw water feed, see Phase 4, Section 4.2.5). Diversion of raw water from the ECCC would require a pond and booster pump to operate sprinklers. Infrastructure within the Morgan Hill development should consider the ability to accept water directly from the reclaimed pipeline or from the ECCC. The magnitude of the demand (58 AFY) may not warrant an additional irrigation pump for the canal deliveries unless there are cost

savings that can be achieved by using water from the canal rather than the reclaimed water line, such as reduced pumping costs from the canal.

4.3.2 Calvary Church

Calvary Church is located along County Line Road near the intersection with Jay Road. The site is approximately 1,000 feet from the SWRF and a branch line from the existing reclaimed line appears feasible, although the branch would have to cross the Lower Boulder Ditch. The same line could be used to supply Lost Creek Farms. Lagoons at the SWRF could be converted into local storage for the branch connection if needed to relieve peak flows in the existing reclaimed line.

4.3.3 Lost Creek Farms

The Lost Creek Farms development is located just west of County Line Road and just north of Jay Road. The site is approximately 2,500 feet from the SWRF and a branch line from the existing reclaimed line appears feasible, although the branch would have to cross the Lower Boulder Ditch and County Line Road. This line would be an extension of the Calvary Church branch line. Depending on the location of the non-potable demand within the development, the branch line could run along the South Boulder Ditch right-of-way to the northern edge of the development. Lagoons at the SWRF could be converted into local storage for this branch connection if needed to relieve peak flows in the existing reclaimed line.

4.3.4 Coal Creek Park

Coal Creek Park is located in northeast Historic Erie on the banks of Coal Creek. The extension from the SWRF to the Bridgewater line is expected to pass very close to this park, and a direct connection to the reclaimed line would be relatively simple. Final alignment of this extension was not available at the time of this Plan, but it is anticipated to be on the same side of Coal Creek as the park, so a creek crossing would likely not be required.

4.3.5 Reliance Park

Reliance Park is located north of Historic Erie, directly across Coal Creek from the SWRF. The park would be supplied by a branch from the existing reclaimed line on the east side of Coal Creek before the line crosses to the west side. . Reliance Park could also be served from the SWRF lagoons, if utilized for local storage for the Calvary Church and Lost Creek Farms extension. The Erie and Coal Creek Ditch is located near Reliance Park and could deliver ditch water or other raw supplies conveyed through the ditch to Reliance Park.

4.3.6 Sunwest North

Sunwest North is located on Meller Street, just east of Red Hawk Elementary School. This development could potentially be served reclaimed water by the Calvary Church and Lost Creek Farms branch if extended southward. However, the Leyner Cottonwood Ditch runs along the southern edge of the subdivision and is located downstream of the lateral from Thomas Reservoir. Deliveries of C-BT water from Thomas Reservoir could be diverted near Sunwest North from the Leyner Cottonwood ditch and pumped by irrigation booster pumps to the irrigated areas. This same delivery system from the Leyner Cottonwood could be extended along a line approximately parallel to the southern property line of Red Hawk Elementary to irrigate other nearby areas, including Red Hawk Elementary School, Meadow Sweet Farms Park and Longs Peak Park. When in priority, shares of Leyner Cottonwood and shares of South Boulder Canon Ditch could be diverted at this location instead of using C-BT. Leyner Cottonwood shares would be limited to use on lands that could be served by gravity on the north side of the ditch to prevent an expansion of historic use of the ditch shares.

4.3.7 Bridgewater

The Bridgewater subdivision is located just east of Historic Erie, north of Erie Parkway, and extending east to Weld County Road 5. The Bridgewater developer is building a pond to regulate non-potable supplies within the subdivision (Bridgewater Pond No. 1), and anticipates using the capacity of an 8-inch pipe. In a previous memo, DWC recommended oversizing the Bridgewater pipe to 12-inches and planning for a local storage pond (Bridgewater Pond No. 2) near the southeast corner of Bridgewater to serve demands farther south and east. The 12-inch pipe would reduce to an 8-inch pipe after the turnoff to the Bridgewater Pond No. 1. Bridgewater Pond No. 2 could be as small as 0.8 AF (260,000 gallons) of active storage to regulate the peak-week flow.

4.3.8 Erie Highlands

Bridgewater is located on the south side of Erie Parkway, east of the Grandview subdivision, extending east to Weld County Road 5. Bridgewater would be supplied with non-potable water through a connection to Bridgewater Pond No. 2.

Erie staff inquired about the potential use of planned storm water detention ponds on the Bridgewater site as active storage for Bridgewater No 2. State regulations would require the detention pond outfall to be permitted as an effluent outfall due to the mixing of waters that would occur during normal storm water detention pond operations. Therefore, double-use of a detention pond to also store reclaimed water is not considered practical at this time. The size of Bridgewater Pond No. 2 needed to regulate the peak week flow is 0.8 AF (260,000 gallons) and potentially could be

accommodated in a small area near the detention pond, but should be isolated from the detention pond.

4.3.9 Sunset

Sunset is located on the west side of Weld County Road 5, approximately a half mile south of Erie Parkway. The non-potable supply for Sunset is identical to Bridgewater.

4.3.10 Section 21 (west)

According to Erie staff, the west half of Section 21 is anticipated to develop in the foreseeable future, but no specific development plans have been submitted at this time. This parcel is located on the east side of Weld County Road 5, south of Erie Parkway. The non-potable supply for Sunset is identical to Bridgewater.

4.3.11 Summerfield

The proposed Summerfield development is located between Weld County Roads 5 and 7, and south of Highway 52. Summerfield would be supplied with non-potable water through the North Line. In addition, the ECCD and the Community Ditch terminate on the Summerfield property. It is anticipated that a local storage pond will be constructed within the development to regulate non-potable supply, and could be expanded to assist in providing service to areas along Interstate 25 further to the south. Raw water supplies from either ditch could be delivered to this pond when in priority and diverting. In addition, the interconnection with the raw water system would allow for delivery of other raw water sources (e.g. C-BT, Windy Gap, NISP or others) to be delivered through the reclaimed system turnout at the Erie and Coal Creek Canal.

4.3.12 Section 10 and Section 15

Sections 10 and 15 are north of Erie Parkway and border Interstate 25 for two miles. These two sections are expected to have commercial development. As described in Section 3.2, the magnitude of these demands could vary significantly depending on the type of commercial development. The areas would be served by the North Line (Phase 2) and could also receive raw water through the interconnection described in Phases 4 and 5 or from the Summerfield pond described above in the Summerfield section.

4.3.13 Section 16

Section 16 is located between Weld County Roads 5 and 7, just north of Erie Parkway. Portions of Section 16 are already developed, including Erie High School located in the southwest portion of the section. Non-potable supply for Section 16 would come from the North Line, but could also obtain water from the Community Ditch which runs through the area. In addition, Section 16 development, including Erie High School could connect to the Bridgewater Pond No. 2 before the North Line is built. Looping of the non-potable system as described in Phase 5 will provide operational flexibility and reliability to meet demands from either the Bridgewater Line or the North Line.

4.3.14 Lehigh Park, Erie Community Park and Erie Commons Filing No. 4

Lehigh Park, the Erie Community Park (including the library, community center and athletic fields) and Erie Commons Filing No. 4 are currently served by non-potable water through the small storage pond located near the Leon Wurl Service Center on the banks of Coal Creek. The pond is filled by the Leyner Cottonwood Ditch with ditch shares and C-BT water released from Thomas Reservoir into the Leyner Cottonwood Ditch. A map of the area provided by Erie staff indicates that there is a potable water tap that can serve the parks in the event of a failure of the pond or pump station. In Phase 3, the pond can also be filled by the southern extension of the reclaimed water line, providing another potential source of water to these areas.

4.3.15 Velodrome, Right Move Lot 6

The Velodrome is located on the west side of County Line Road at the intersection with Bonnell Avenue. Right Move Lot 6 is located just east of County Line Road on Bonnell Avenue. There is an existing non-potable water line connected to the Erie Community Park pond that runs parallel to Bonnell Avenue that could be extended to the west to meet both demands with raw water. This line could also serve the Leon Wurl Service Center. Connection of the pond with the reclaimed water line in Phase 3 would provide the opportunity to deliver both raw water and reclaimed water.

4.3.16 Golden Run

Golden Run is proposed development located west of County Line Road, just south of the intersection with Bonnell Ave. and extending west to 119th St. The northern property line of the Golden Run development is located directly east of the Lynn R. Morgan WTF. The southern property line is located parallel to Vista Parkway and the Vista Ridge pump station located where Vista Ridge crosses Coal Creek. Both of these locations are important for the raw water interconnection with the reclaimed water

system in Phase 4. It is important to include an appropriate right-of-way for the 16-inch line through the Golden Run development with an eventual connection to the reclaimed water system at or near the Vista Ridge pump station (see Phase 3 for description of the southern extension of the reclaimed water line).

The Golden Run development itself would be served via a branch connection from the reclaimed water system as described in Phase 3. Both the reclaimed water line and the raw water supply line from the Morgan WTF would also serve Compass.

4.3.17 Compass

Compass is a 160 acre development located west of County Line Road, between the intersection with Arapahoe Road and Vista Parkway. Non-potable water would be served to Compass as a branch from the southwest extension of the reclaimed water line described in Phase 3. In addition, the line that connects the reclaimed system and the raw water system may run along the northern boundary of Compass (see Golden Run above). The same line that serves Golden Run would also serve Compass.

4.3.18 Sierra Vista, Vista Ridge Filing No. 6 and Convair Hangars

Sierra Vista, Vista Ridge Filing No. 6 and Convair Hangars are all located near the Erie airport along the southern boundary of the Erie service area. These areas would be served in Phase 3 through a southern extension from the Vista Ridge pump station area. This line could potentially be installed parallel to the primary runway at the Erie airport to avoid construction through the Vista Ridge residential development.

4.3.19 COLORADO NATIONAL Golf Course

The Colorado National Golf Course diverts water from Coal Creek just north of where Vista Parkway crosses Coal Creek. Water is pumped from this diversion point to the golf course system. The golf course currently leases Erie consumable effluent in order to divert water by exchange at this point. Water in Coal Creek contains bryozoan and the majority of the flow is effluent from Lafayette's wastewater treatment plant, located just upstream of the diversion. Erie's reclaimed water may be of higher quality than the water in Coal Creek and does not contain bryozoan.

The current use of Erie's consumable effluent by exchange is advantageous to Erie and the golf course, and would likely continue into the future as long as there is physical availability of water in Coal Creek. This operation allows Erie to utilize its consumable effluent without having to physically pump the water to the Vista Ridge pump station, and allows the golf course to not have to acquire water rights independent of the Town. Once the

interconnection between the raw water and reclaimed water systems is made in Phase 4, the golf course would have the option of using higher quality raw water sources instead of the lesser quality water in Coal Creek.

4.3.20 Columbine Park

Columbine Park is located within the Vista Ridge subdivision. The park is supplied by non-potable water delivered through the Colorado National Golf Course infrastructure. Erie pays the golf course a fee for use of the golf course infrastructure, but provides the water used to irrigate Columbine Park via exchange to the diversion point on Coal Creek. This area would be more difficult to serve with new infrastructure connected to the Erie non-potable water system due to the existing residential development that surrounds this park. Continued use of the existing golf course infrastructure is the most efficient way to supply the park with non-potable water, provided an agreement acceptable to both parties can be reached.

4.3.21 Pratt

The Pratt development is located north of Vista Ridge. Pratt would be served non-potable water from the southeast extension described in Phase 3. Pratt could also potentially be served from the north in Phase 1. This would require pumping over one of the highest points in Erie (the intersection of Weld County Road 5 and Weld County Road 6). Service from the north may be a feasible option if the timing of construction of Pratt aligns better with Phase 1 than Phase 3 of the Plan. Depending on available capacity in the Colorado National Golf Course infrastructure, a third option would be to serve the Pratt development by extending the golf course infrastructure to Pratt and coming to an agreement with the golf course for capacity.

4.3.22 Longs Peak Park, Country Fields Park

Longs Peak Park and Country Fields Park are located approximately a half-mile north of Erie Parkway, just west and east of 119th Street, respectively. These parks are relatively remote from proposed reclaimed water lines and would likely be best served through an expansion of the raw water distribution system. Potential for service from the reclaimed system would come from the east branch line from the existing reuse line described in the Lost Creek Farms section above. The branch that serves Lost Creek Farms could be extended to the south and west.

The Leyner Cottonwood Ditch is located near the parks, but these parks are upstream of the lateral from Thomas Reservoir and are located above the ditch. Deliveries of surplus raw water can be delivered via the Thomas Reservoir lateral to the Leyner Cottonwood Ditch and pumped up to the two parks and the Sunwest North development (see Sunwest North, above).

This system would rely on surplus raw water supplies, including South Boulder Canyon Ditch rights, Leyner Cottonwood ditch rights that have been changed to municipal use and other available surplus water supplies. This portion of the non-potable system would not connect to the reclaimed water system.

4.3.23 Flatiron Meadows, Wise, Rex Ranch, Candlelight Estates

Flatiron Meadows, Wise, Rex Ranch and Candlelight Estates are all located in the western part of Erie. Raw water diverted into a pipeline at the inflow to the Lynn Morgan WTF could distribute raw water supplies to these areas. In addition, the Leyner Cottonwood Ditch runs through or borders all developments except Rex Ranch. Raw water distribution lines can discharge into the ditch and be re-diverted at the down-ditch developments for use. Construction of a raw water distribution system is not dependent on the progress of the reclaimed water system, and can be constructed with any Phase.

Section 5: Non-Potable System Operation

This section describes operations of the non-potable system, including an analysis of the availability of non-potable water based on Erie's water portfolio, water use and water reclamation facilities. There are several potential ways of maximizing the raw water supply in exchange for the NWRF reclaimed water that are described for further consideration.

5.1 Availability of Non-Potable Water

The annual non-potable demand that can be met through the phased Plan is approximately 1,700 AF to 2,100 AF. This demand can be met from storage of approximately 1,000 AF of consumable effluent at the NWRF reservoir, use of ditch shares, direct use of consumable effluent that does not need to be stored in the NWRF reservoir, and from other surplus raw water supplies such as C-BT, Windy Gap or future acquisitions of other water rights. Currently, Erie's water supply portfolio can generate at least 1,000 AF of consumable effluent to fill the NWRF reservoir by treating its Windy Gap water in the winter months. In the future, Windy Gap Firming and NISP will yield approximately 7,700 AFY of first-use supply that will generate consumable effluent in excess of 1,000 AFY.

In many years, Erie will generate more consumable effluent than can be stored at the NWRF reservoir. Excess effluent can either meet a non-potable demand instantaneously, or be leased to other water users for direct use or augmentation Storage of consumable effluent at the NWRF reservoir in the winter maximizes the volume of effluent returned through the system to the NWRF and can supply approximately 1,000 AF of the non-potable demand through the reclaimed water system.

Most of Erie's ditch water rights have not been transferred to municipal use. Generally, these rights can be used unchanged for irrigation of parks and rights-of-way on lands that have been historically irrigated under the ditch or were part of the originally decreed service area for the ditch. This limits the use of some of Erie's unchanged ditch shares to specific regions and requires detailed water accounting if these shares were to be diverted into the non-potable distribution water system to show that these shares are used on the lands under the ditch system. The areas that can be irrigated through diversions from ditches and are under the historical ditch are listed in Table 5-1. Ditch shares that have not been changed generally

Table **5-1.** Demand That Can Be Met by Ditch Raw Water Connections

Ditch	Demand Area	Annual Demand (AF)	Annual Demand + 25% (AF)
Leyner-Cottonwood	Erie Community Park and Community Center	83	104
	Sunwest North	7	9
	Wise	37	46
	subtotal:	**127**	**159**
South Boulder Canyon Ditch	Arapahoe Ridge Park	13	16
	Candlelight Estates	9	12
	Country Fields Park	14	18
	Compass	37	46
	Flatiron Meadows	37	46
	Golden Run	74	92
	Longs Peak Park	18	22
	Rex Ranch	16	20
	Right Move Lot 6	1	1
	Velodrome	2	3
	subtotal:	**208**	**260**
Erie and Coal Creek	Summerfield	144	180
	subtotal:	**144**	**180**
	Total	**479**	**598**

cannot be stored for extended time periods, and must be used directly. Erie has changed 155 shares of Leyner Cottonwood to municipal use, but cannot be delivered to the potable system or Erie's potable reservoirs unless the South Boulder Canon Ditch is also diverting water (see Section 2.3). The demands shown in Table 5-1 were used in the model to limit the amount of non-potable demand that ditches could meet in the system by quantifying only the demands under the Leyner Cottonwood, South Boulder Canon and Erie and Coal Creek Ditches. Prince and Thomas Reservoirs are also decreed for irrigation and water stored in priority in these reservoirs can be used to irrigate lands below the reservoirs, which generally corresponds with the Leyner Cottonwood ditch service area and some portions of the South Boulder Canon Ditch service area.

Comparing the average annual ditch yield (Table 2-1) and Table 5-1 indicates that more than half of the average annual ditch yield to Erie cannot serve lands where there is non-potable demand without a change of use to allow irrigation of these parks outside of the location of historic use. However, the dry year yield could be fully used on parks located on the historically irrigated lands.

A spreadsheet model was developed to simulate the availability and location of non-potable supplies and the ability to meet projected demands from these sources. Monthly demands projected in Figure 3-4 were used as model input. This demand was further divided into the following categories:

- Demands that can be met by raw water only
  - Western subdivisions with no proposed connection to the reclaimed water system (188 AF) for both current and future conditions (Arapahoe Ridge Park, Longs Peak Park, Country Fields Park, Candlelight Estates, Flatiron Meadows, Rex Ranch, Sunwest North, Wise)

- Demands that can be met by reclaimed water only
  - Currently, this includes only the Colorado National Golf Course exchange of 300 AF. However, it can also include demands in Phases 1 and 2 prior to the interconnect of the raw and reclaimed water system
  - After Phase 4, the Colorado National Golf Course can be supplied by reclaimed water by exchange, reclaimed water by

direct connection, or raw water from the interconnect with the raw water system

- Demands that can be met by either reclaimed water or raw water
  - Currently, there is no connection between raw and reclaimed systems and current conditions demand is zero
  - After Phase 4, most demands can receive water from either source

5.1.1 Model Scenarios

Four scenarios were developed for the model with the following inputs:

1. Current system
   a. Ditch yield of 1,242 AF (Table 2-1)
   b. C-BT quota 70 percent
   c. Windy Gap average year yield 1,400 AF consumable
   d. Non-potable demands 404 AF (golf course and Columbine Park 316 AF, Erie Commons area 88 AF from Table 3-2)

2. Future system, average and wet years
   a. Ditch yield of 1,700 AF (Table 2-1, excluding FRICO shares and winter diversions)
   b. C-BT quota 70 percent
   c. Windy Gap average year yield 1,400 AF consumable
   d. NISP online (6,500 AF at 40% reusable)
   e. Non-potable demands 2,100 AF (Table 3-1, last column)

3. Future system, extended drought
   a. Ditch dry-year yield of 120 AF (Table 2-1)
   b. C-BT quota 50 percent after multiple dry years
   c. Windy Gap is firmed; (1,200 AF)
   d. NISP online (6,500 AF at 40% reusable)
   e. Non-potable demands 2, 100 AF (Table 3-1, last column)

4. Future system, enlarged NWRF Reservoir
   a. Same as scenario 2 except NWRF reservoir enlarged to 2,000 AF

A scenario representing current system, extended drought was not simulated because during recent drought conditions, Erie was able to use C-BT supply as collateral for Windy Gap water thereby obtaining sufficient reusable supply to meet current non-potable demands in a manner similar to other years.

5.1.2 Model Configuration

The model simulates one water year of operations, beginning in November and ending in October. The model was configured to meet demands first

from available ditch supplies (on lands that can be irrigated with ditch water), then direct use of consumable effluent at the NWRF, release of consumable effluent from the NWRF reservoir, and lastly from other raw water supplies (e.g. surplus C-BT or changed ditch shares). The model uses surplus raw water to meet any demand shortages after the reclaimed water is used and was not limited by actual Erie water supplies. It is anticipated that Erie's water supply will increase as the population increases and the amount of surplus raw water will vary in any given year based on the makeup of the future portfolio. The amount of raw water used in the model is the amount of surplus water that will be required to meet the non-potable demands.

In years with surplus raw water, the system can be changed to prioritize meeting the non-potable demand from raw water supply before reclaimed water from the NWRF. The amount of available raw water will vary based on Erie's future water portfolio. Based on the current portfolio, Erie has large amounts of surplus water in high C-BT quota years. In these years, non-potable demands can be met with C-BT without negatively affecting the reliability of the potable water system. The extent of development of the non-potable infrastructure will directly affect how much of the demand can be met with raw water. For example, in Phases 1, 2 and 3, the reclaimed water and raw water systems are still isolated from each other and C-BT could meet only a limited amount of demand in the western area or through the potable system. In Phases 4 and 5, the interconnection between the systems is built, and C-BT can be used to supply most demands throughout the service area. Use of surplus C-BT for non-potable demands would free up any Windy Gap or NISP supplies for leasing to other water users or carrying over in Northern Water's reservoirs.

5.1.3 Model Results

The model results for each scenario are comprised of a chart that shows the monthly non-potable demand and the sources used to meet the demand, and another chart that shows the NWRF reservoir contents, inflows, outflows and spills of reusable effluent. A discussion of the results follows the charts for each scenario.

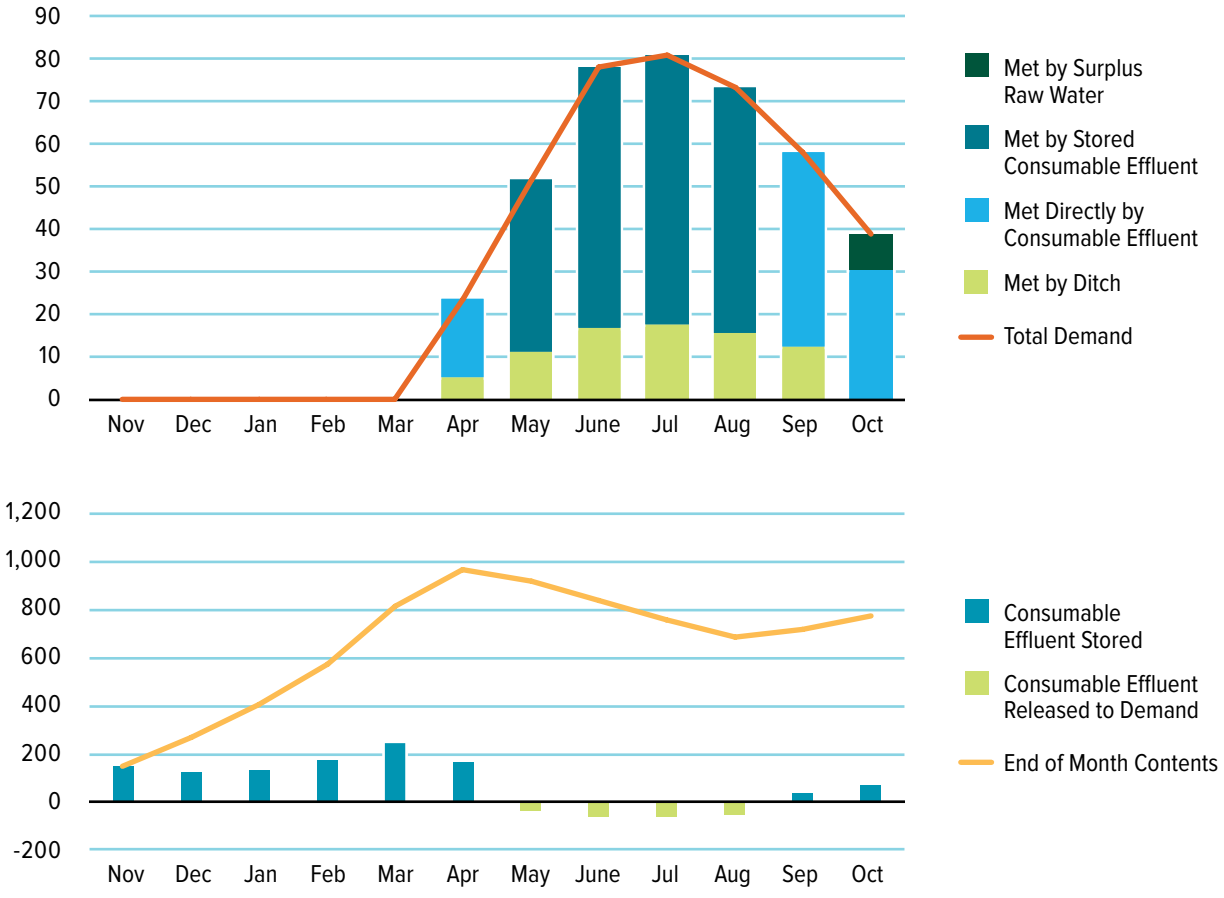
The results for Scenario 1 (current conditions) are shown in Figure 5-1, and indicate that most of the current non-potable demand can be met by ditch water and consumable effluent generated at the NWRF, but a small amount of surplus raw water is needed in the late season to irrigate the Erie Commons area in October. Ditch reservoir water could be used to meet this demand. The current Erie winter potable demand is less than the full Windy Gap yield of 1,400 AF, so not all Windy Gap water can be used through the potable system and stored in the winter. Windy Gap was used for the entire potable demand November through March and in October, and approximately half of the April demand. The demand for reclaimed water is entirely from the Colorado National Golf Course and Columbine Mine Park exchange because the reclaimed water system is

not yet connected to other demands. The Erie Community Park and Erie Commons areas can only be served by the raw water system, and the ditch rights are not sufficient to meet the full demand in October, requiring use of C-BT water or ditch water stored in Prince or Thomas Reservoirs. In dry years when ditch supplies yield less than shown (see Table 2-1), additional C-BT water would likely be used in its place. The reservoir contents chart in Figure 5-1 indicates that there are no spills of consumable effluent, but that storage in the NWRF reservoir increases over the year. The following year would start with contents at 800 AF and would result in spills of effluent the following winter. With the current level of demands (potable and non-potable), Erie will have a surplus of water in years it has Windy Gap yield and an average or higher C-BT quota, with sufficient supplies to meet small non-potable demands with stored ditch water or C-BT water without affecting the system.

figure **5-1.** Non-Potable Water Availability Model Results – Scenario 1

Current system, average and wet years.

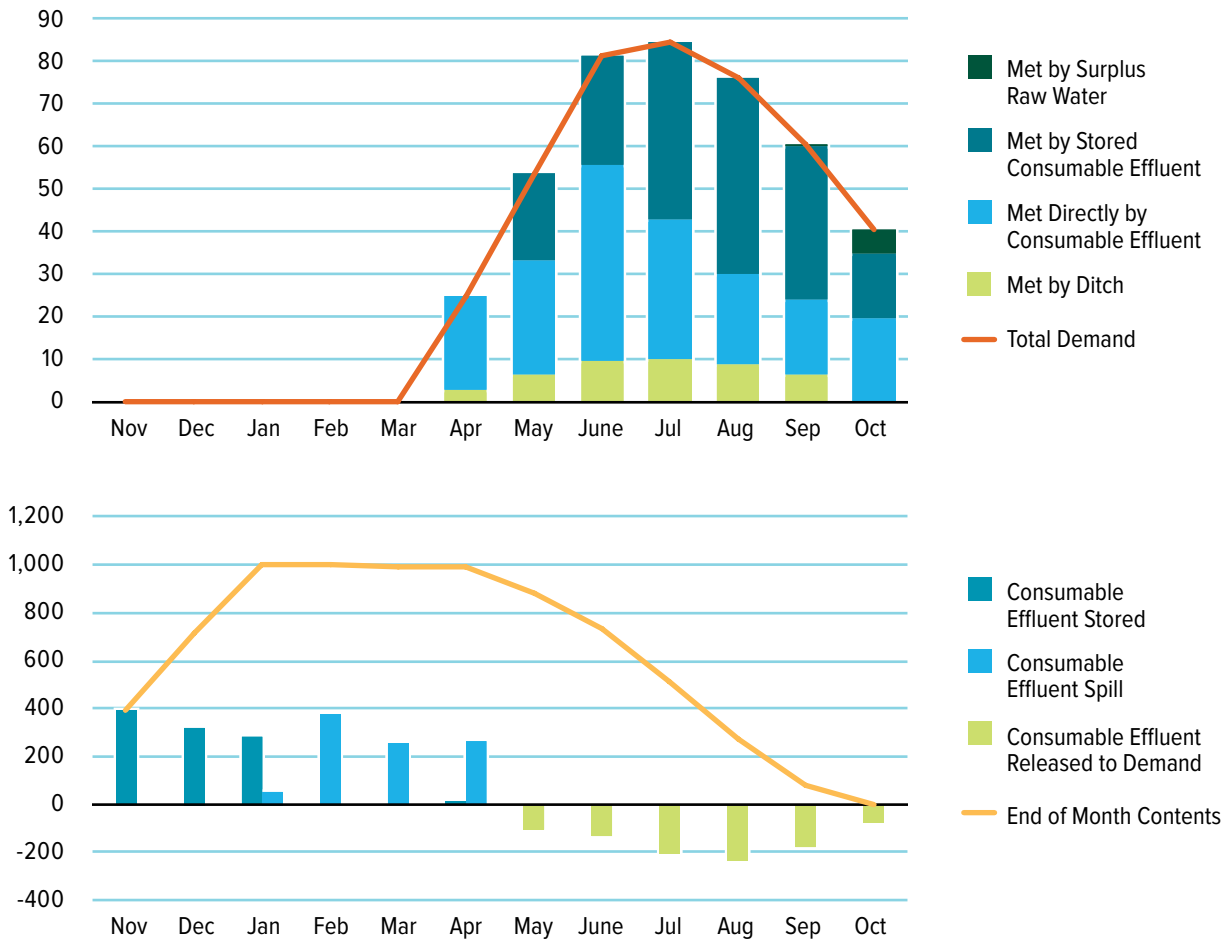
Note: dry years would require C-BT instead of ditch supply



The results for Scenario 2 (average and wet year, future conditions) are shown in Figure 5-2, and indicate that non-potable demands are met in large part by ditch water and stored reclaimed water at the NWRF reservoir. In a similar manner to current conditions, the future supply of Windy Gap can meet the Erie potable demand (projected at 8,600 AF [7,500 AF plus 13% losses per HE 2011]) through the middle of February. In February, NISP water is utilized for the remainder of the winter months and into April and October. Windy Gap water is used preferentially in November through February due to the higher return flow factors in those months. NISP is then used throughout the remainder of the year, preferentially in months with higher return flow factors. Treating 1,400 AF of Windy Gap and 6,500 AF of NISP water in this manner results in nearly 2,900 AF of reusable effluent. This amount exceeds the projected non-potable demands estimated at 1,700 to 2,100 AF. However, some non-potable demands

figure **5-2.** Non-Potable Water Availability Model Results – Scenario 2

Future system, average and wet years.

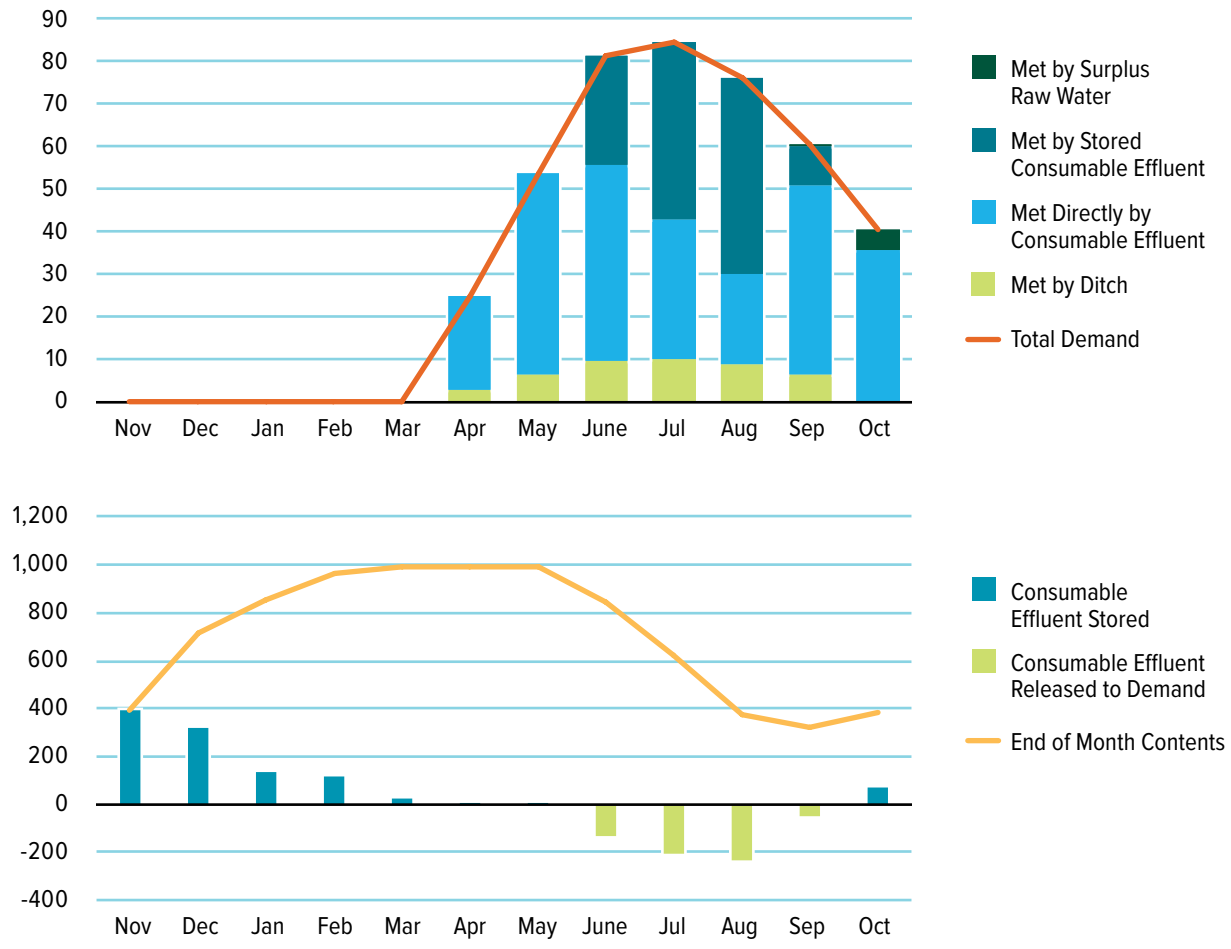


cannot be met with reclaimed water (western subdivisions and parks) and will still rely on ditch water or other surplus supplies.

Figure 5-2 shows that the NWRF reservoir is completely empty in October of an average year, and non-potable demands must be met by other surplus raw water. This indicates that maximizing the generation of consumable effluent is not necessarily the most effective manner of meeting non-potable demands because more effluent is generated in the winter than can be stored. Figure 5-3 shows that by shifting the use of Windy Gap throughout the year to generate more consumable effluent that can be used directly, winter spills of consumable effluent are reduced, water is carried over in the NWRF reservoir, and the need for surplus raw water in October is limited to only areas that can be served by raw water only (western subdivisions and parks).

figure **5-3.** Non-Potable Water Availability Model Results – Scenario 2 with modified use of WG and NISP

Future system, average and wet years with goal of reducing consumable effluent spills and maintain storage in NWRF reservoir for late season demands



The results for Scenario 3 (dry year, future conditions) are shown in Figure 5-4, and are similar to the future conditions average and wet years except that the ditch supply is significantly lower (110 AF compared to 1,700 AF in average and wet years). The reduction in ditch water results in the use of most of the dry-year ditch yield in the early part of the irrigation season (April, May, June), with reliance on other surplus water supply in the later part of the irrigation season when the ditch rights are out of priority and not diverting (there is no dry-year yield for the reservoirs). Similar to average and wet years, the use of Windy Gap and NISP supplies can be shifted to reduce spills of consumable effluent and maintain water in the NWRF reservoir through the irrigation season (see Figure 5-3).

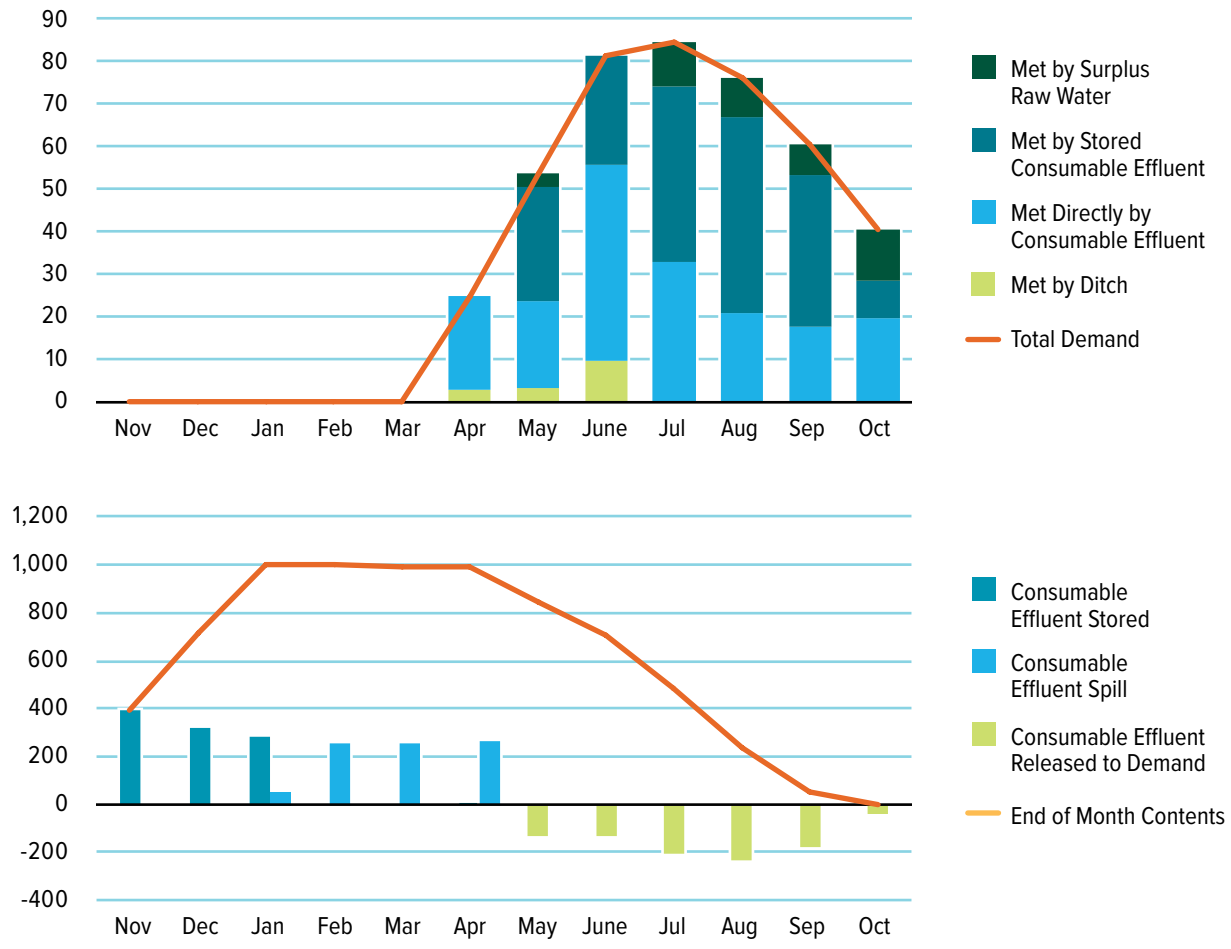
Figures 5-2, 5-3 and 5-4 show that Erie has a sufficient amount of storage in the NWRF and sufficient reusable water supply to meet most of the non-potable demand of up to 2,100 AF even in dry years. In dry years when ditch water rights have limited yield, demands that can only be met by raw water sources (western subdivisions and parks) could use a raw water source such as C-BT or first use of Windy Gap or NISP water. This amount of first-use water for non-potable use represents approximately 250 AF, of which approximately 100 AF can be met by dry-year ditch yields.

Figure 5-3 shows that Erie can generate reusable effluent throughout the summer to directly meet non-potable demands. However, treating reusable supplies in the summer when a large portion of the water goes to outdoor watering use reduces the amount of reusable effluent that can be generated. Reusable effluent is a valuable resource that can be used in a number ways other than reclaimed water, such as leasing for well augmentation or meeting return flow obligations from changed agricultural water rights. Scenario 4 was developed to maximize the production of reusable effluent, and includes enlarging the NWRF reservoir to 2,000 AF to store a larger portion of this water for use in the non-potable system and for other potential uses. Additional storage could be realized through an enlargement of the existing NWRF Reservoir or development of storage at one of the gravel mining sites located in the vicinity. Windy Gap is used exclusively in winter months, and NISP water is allocated preferentially to months with higher wastewater return flow factors, but is still used to some extent in summer months. The results are shown in Figure 5-5 and show that at the end of a year of maximizing reusable effluent production, there is approximately 1,000 AF of reusable effluent in storage going into the winter. This indicates approximately 1,000 AF of reusable effluent could be made available through the summer for other potential uses with an enlarged NWRF reservoir. Alternatively, if a use can be found for reusable effluent through the winter months, the additional storage would not be required to use the surplus reusable effluent. As Erie's potable and non-potable demands grow beyond the next 20 years, Erie will be able to generate even larger amounts of reusable effluent by preferentially using reusable sources exclusively during the winter months.

All the model scenarios prioritize the use of reclaimed water before using raw water supplies. The amount of surplus raw water is directly related to the potable system demands and was not analyzed in this study.. Except in years with a low C-BT quota, Erie will likely have surplus water until potable demands increase to levels approaching the average C-BT yield (see Figure 2-1). As Erie grows, the amount of surplus will decrease as increasing amounts of raw water will be needed to meet potable demands. In years with surplus raw water, Erie will have the opportunity to deliver high quality raw water to areas normally served with reclaimed water. The interconnection between the raw water system and the reclaimed water system is described in Phase 4 and is a key link to be able to supply raw water to the majority of Erie's non-potable demands. Supplying raw water through the reclaimed water system has the benefit of flushing salts from the soils that build up over time with reclaimed water irrigation.

figure **5-4.** Non-Potable Water Availability Model Results – Scenario 3

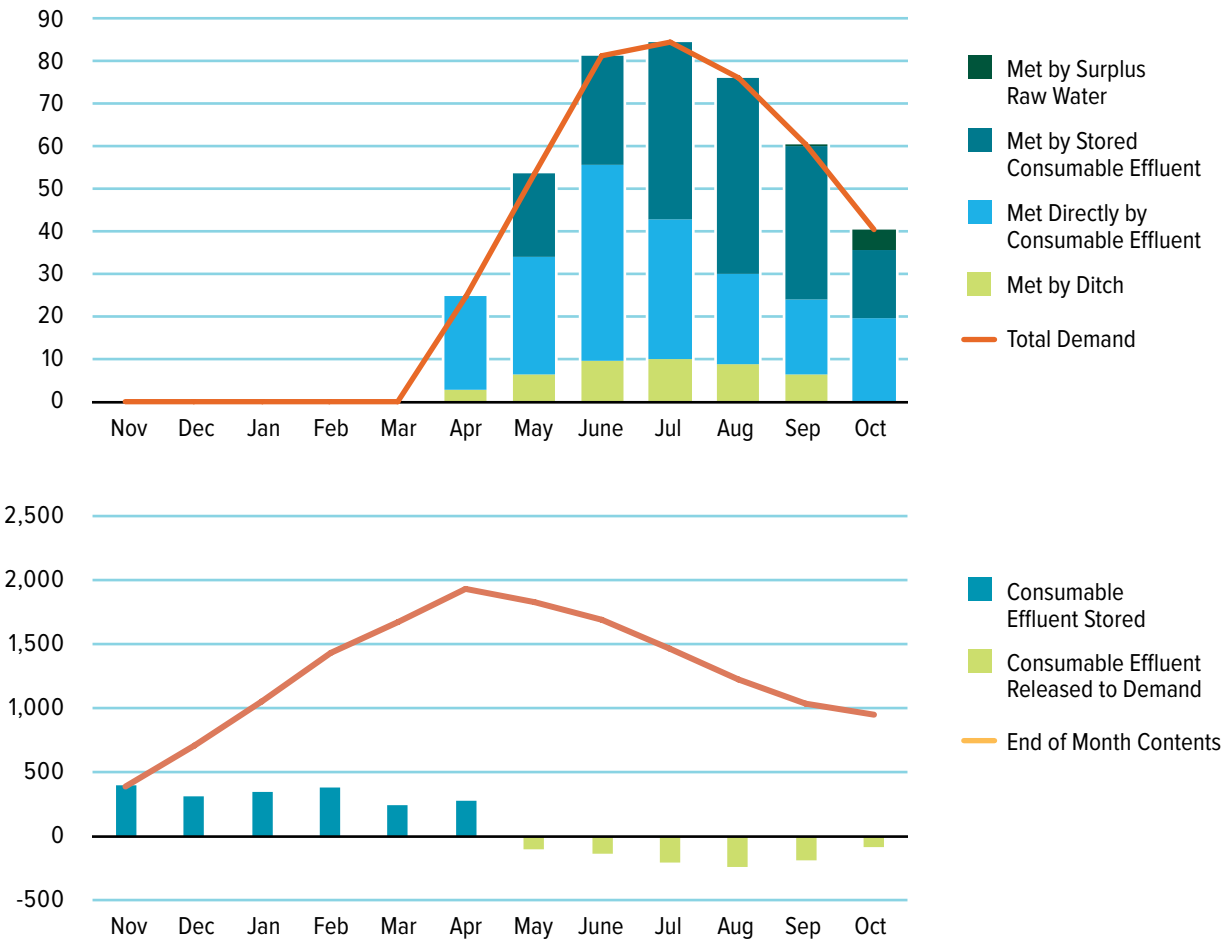
Future system, dry years



In addition, it provides operational flexibility to serve these areas in the event of a shortage of Windy Gap or NISP water. At the time of Phase 4 design, these benefits should be compared to the additional costs of tying the raw water system into the non-potable system and the future reductions in surplus raw water supplies as demands increase.

figure **5-5.** Non-Potable Water Availability Model Results – Scenario 4

Future system, average years with goal of maximizing reusable effluent in enlarged NWRF reservoir



5.2 Other Operations to Maximize System Flexibility

In addition to the operational scenarios described in Section 5.1, there are other possibilities for maximizing the use and reuse of Erie's water supply, and for potentially obtaining more high quality raw water. The following concepts do not require additional infrastructure, but would require agreements with other water users, and may require additional water rights and legal analysis to determine the feasibility.

- Exchange reusable effluent in the NWRF reservoir for C-BT water at either the Southern Delivery Pipeline intake at Carter Lake or the Erie pipeline intake from the Boulder Supply Canal diversion.
  - Requires a C-BT allottee that is diverting C-BT downstream of the NWRF outfall or upstream with exchange potential between the upstream headgate and NWRF outfall.
  - Erie could either book-over water in the Northern storage facility or take delivery through its pipelines

- Exchange reusable effluent in the NWRF reservoir for additional supply at the South Boulder Canon Ditch headgate to deliver additional supplies to Erie's reservoirs.
  - Exchange reach is extensive from the NWRF on Boulder Creek to the diversion point on South Boulder Creek and would likely only be feasible during times of high flow

- Flush the NWRF reservoir with water from Boulder Creek
  - Release NWRF effluent and fill with a like amount of Boulder Creek
  - Fill only during times of good water quality on Boulder Creek, generally during times of high flow

- Lease surplus effluent from Windy Gap or NISP that is not stored
  - Trade reusable effluent for raw C-BT with a downstream provider that needs reusable effluent and has surplus C-BT. This may not be an acre-foot for acre-foot trade, but would result in a new raw water supply to Erie.
  - Develop a revenue stream for Erie to offset non-potable operations and maintenance costs.

- File for Lawn Irrigation Return Flow (LIRF) credits for Windy Gap, NISP and reclaimed water applied to landscaping in Erie. This could enable further leasing of reusable supply to downstream water users or diversion by exchange into the Erie non-potable system near the NWRF.

Section 6: Opinion of Probable Costs

An estimate of planning level capital costs for system infrastructure was developed and is broken out into the phases contained in the implementation plan above. Costs include pipeline, pump stations, storage, diversions, design, inspection and contingencies.

The pipeline costs are based on estimated length and size of pipe, assumption of rural construction, and unit prices from recent regional pipeline cost guidelines used by Denver Water (Denver Water 2013). Alignments in currently undeveloped areas will be assumed to be constructed by developers and located in roadway rights-of-way (ROWs); therefore, no land acquisition costs will be included. Similarly, for alignments in developed areas, pipelines will assume to be installed in established roadway ROWs. Pump station costs were also estimated from the Denver Water cost guidelines. Table 6-1 shows the estimated costs by Phase.

Based on Table 6-1, the total capital cost of the non-potable system are approximately $14 million. At a demand level of 2,100 AF, the cost is approximately $6,700 per AF.

Table **6-1.** Capital Cost Estimates by Phase

Phase 1

Infrastructure	Unit Type	Unit Cost	Amount	Cost	Notes
16-inch extension from SWRF to Bridgewater	$/LF	$131	1,500	$196,500	
12-inch extension from Coal Creek to Bridgewater Pond No. 1	$/LF	$109	4,000	$436,000	Bridgewater developer is responsible for cost of 8-inch line. Oversizing costs will be reimbursed by future developers. Measurement is center of Bridgewater development (assumed Pond No. 1 site)
8-inch extension from Bridgewater Pond No. 1 to Bridgewater Pond No. 2	$/LF	$99	3,000	$297,000	Measurement is to SE corner of Bridgewater (assumed location of Pond No. 2)
8-inch extension from Bridgewater Pond No. 2 south to Bridgewater, Sunset Section 21	$/LF	$99	3,000	$297,000	
Bridgewater Pond No. 2 for distribution to South and East	$/AF	$10,000	10	$100,000	Assumes some inactive capacity for aesthetics
Pump station from Bridgewater Pond No. 2 to south extension	each	$150,000	1	$150,000	Pump station does not need to be built until development begins to the south
Turnout to ECC ditch	each	$125,000	1	$125,000	includes meter vault, SCADA
Branches to Morgan Hill, Reliance Park, Coal Creek Park, Calvary Church, Lost Creek Farms	each	$100,000	4	$400,000	includes meter vaults and SCADA
Instrumentation and control system for non-potable system with sufficient capacity to expand through proposed Phases	each	$250,000	1	$250,000	
Phase 1 Total				**$2,251,500**	

Phase 2

Infrastructure	Unit Type	Unit Cost	Amount	Cost	Notes
16-inch North line 16" (parallel the new sewer line, serve Summerfield, S16, S15, S10)	$/LF	$131	26,000	$3,406,000	route follows Highway 52 and Weld County Road 7 to the middle of Section 15
Pump Station upgrade for North Line	each	$500,000	1	$500,000	Assume a second pump station or an upgrade to the existing pump is needed for the North Line
Pond for North Line system	$/AF	$20,000	10	$200,000	Assumes some inactive capacity for aesthetics, may not be needed unless demands along this line exceed projections

Table **6-1.** Capital Cost Estimates by Phase

Phase 2 Total				**4,106,000**	

Phase 3

Infrastructure	Unit Type	Unit Cost	Amount	Cost	Notes
16-inch South Line extension from Bridgewater Line to Vista Parkway	$/LF	$131	10,000	$1,310,000	Alignment will genrally follow Coal Creek right-of-way
8-inch extention to southwest corner of Pratt	$/LF	$99	4,000	$396,000	Alignment along bike path, mostly undeveloped, will cross Vista Parkway
8-inch Southwest Line extension to west to Golden Run and Compass	$/LF	$130	2,500	$325,000	From Vista Ridge Pump Station to County Line Road
8-inch extension to the South for Sierra Ridge, Vista Ridge Filing No. 6 and Convair Hangars	$/LF	$99	12,500	$1,237,500	Alignment follows Erie Airport runway, branches at southern end of runway to the west for Hangars, east to developments
Connection to Parks Pond (for Erie Commons)	each	$100,000	1	$100,000	Connection to pond allows for reuse water to serve Erie Commons and Community Park in addition to existing raw water use. Includes meter vault and SCADA
Connection to Vista Ridge pump station	each	$100,000	1	$100,000	Connection to pond allows for reuse water to serve Erie Commons and Community Park in addition to existing raw water use. Includes metering and SCADA
Phase 3 Total				**$3,468,500**	

Phase 4

Infrastructure	Unit Type	Unit Cost	Amount	Cost	Notes
16-inch interconnection with raw water system at or near the Morgan WTP	$/LF	$131	9,500	$1,244,500	From WTP to County Line Road where Phase 3 Southwest line ends
8-inch raw water line to Flatiron Meadows, Candlelight Estates, discharge to Leyer-Cottonwood Ditch	$/LF	$99	5,500	$544,500	
6” raw water feed from Leyner-Cottonwood diversion to Sunwest North, Country Farms Park, Longs Peak Park	$/LF	$94	5,000	$470,000	From WTP to Flatiron Meadows parks
Leyner-Cottonwood diversion structures and irrigation pump house (one located at WISE, one located near Sunwest North)	each	$100,000	2	$200,000	new ditch headgates to irrigation pump houses. Metering and SCADA
Backflow prevention/ air gap separation at interconnection point	each	$250,000	1	$250,000	
Raw water pump station at Morgan WTP site	each	$600,000	1	$600,000	Allows raw water pumping back through non-potable system to flush lines and salts from soils. May be able to pump up to Bridgewater Pond

Table **6-1.** Capital Cost Estimates by Phase

Phase 4 Total				**$3,309,000**	

Phase 5

Infrastructure	Unit Type	Unit Cost	Amount	Cost	Notes
8-inch line to loop Bridgewater Pond	$/LF	$99	8,000	$792,000	ability to loop-connect the North Line to the Bridgewater Line and Bridgewater Pone No. 2 system for system redundancy and maximizing use of existing 24-inch line from NWRF
Phase 4 Total				**$792,000**	

Total — All Phases				**$13,927,000**	

Notes:

All costs and lengths are approximate. Preliminary engineering required to refine costs

Cost estimates include construction, design, normal easement acquisition and contingencies

Pipe unit costs based on 2013 Denver Water cost estimates for undeveloped lands

Additional costs for boring or tunnelling are not included

Environmental Permitting costs are not included

Non-Potable Irrigation Landscaping Resources

There are multiple resources available to assist in landscape design and management using reclaimed water. The following is brief description of two Colorado and Denver area specific reports, along with references to more general information.

Rocky Mountain Section of the American Water Works Association (RMSAWWA) and the Rocky Mountain Water Environment Association (RMWEA) joint study "Managing Reuse Salinity for Healthy Landscapes" provides a discussion on drainage, advantages of flushing the soils (such as with surplus raw water as recommended in this Plan), and provides guidelines for baseline salinity testing of the irrigation supply and the soil. The report also provides a listing of salt-resistant plants for different levels of salt tolerance.

http://www.rmwea.org/reuse/docs/Managing%20Salinity%20in%20Landscape%20Irrigation%20final%20doc.pdf

Denver Water report on reclaimed water quality, effect on soils, and effect on trees. The report concludes that sodium buildup in soils and plant tissue was of concern, and one possible solution included flushing of salts with potable water, similar to what is recommended in this Plan during years of excess water supply.

http://www.denverwater.org/docs/assets/3F474251-95AA-CE4F-1BD9CD77E18DC541/SoilTreeReport.pdf

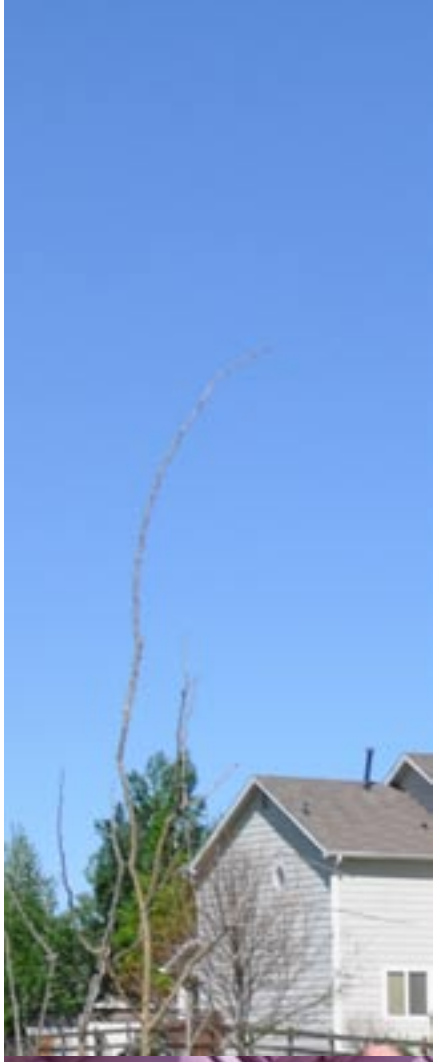
Other resources cited by research articles on use of reclaimed water:

Hayes, A., C. Mancino, and I. Pepper. 1990. Irrigation of turfgrass with secondary sewage effluent: I. Soil and leachate water quality. Agron. J. 82:939-943.

Matheny, N., and J.R. Clark. 1998. Managing landscapes using recycled water. In The Landscape Below Ground II. Neely, D., and G. Watson, eds. International Society of Arboriculture, Champaign, IL. 265pp.

Parnell, J. 1988. Irrigation of landscape ornamentals using reclaimed water. Proc. Fla. State Hort. Soc. 101: 07-110.

Pettygrove, G., and T. Asano. 1985. Irrigation with Reclaimed Municipal Wastewater – A Guidance Manual. Lewis Publishers, Chelsea, MI.



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